COLLINS

overhaul manual

Collins Radio Company

51RV-2B
VOR/ILS Receiver

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(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

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VOR/ILS Receiver

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FOREWORD

This manual has been prepared in accordance with Air Transport Association Specification No. 100 for Manufacturer's Technical Data. If used as intended, this manual will facilitate the effective, continued operation of the 51RV-2B VOR/ILS Receiver.

This manual contains functional (go/no-go) checks that may be used to determine whether the 51RV-2B VOR/ILS Receiver needs repair. Information included in the illustrated parts list makes it possible to identify 51RV-2B planar assemblies, interconnect unit, and front panel by the Collins part number.

The following is a list of related publications:

PUBLICATION	COLLINS PART NUMBER
51RV-2B VOR/ILS Receiver Maintenance Manual (with illustrated parts list)	523-0760758
1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual	523-0760759
844A-1 VOR/LOC Instrumentation Planar Assembly Overhaul Manual	523-0760756
951A-1 Glideslope Receiver Planar Assembly Overhaul Manual	523-0760760
313N-1 Radio Set Control Instruction Book	523-0722000
313N-2 Control Unit Instruction Book	523-0754001
313N-3 Control Unit Instruction Book	523-0752001
313N-4/4A/4B/4C/4D VHF Control Instruction Book	523-0756631
313N-6/6B/6C/7 VHF Control Instruction Book	523-0756633
37P-2/3/4/5 Glideslope Antenna Instruction Book	523-0755809
37J-3 VHF Navigation Antenna Unit Instructions	TD-181
390Y-1/2 Shockmount Overhaul Manual (with illustrated parts list)	523-0756911
329B-4 ( ) Approach Horizon Overhaul Manual	523-0756042
329B-6D/E Flight Director Indicator Overhaul Manual	523-0755792
329B-7/7 ( ) Flight Director Indicator Overhaul Manual	523-0756711
329B-8C Flight Director Indicator Overhaul Manual	523-0757538
331A-4 ( ) Course Indicator Overhaul Manual	523-0755469
331A-6A Course Indicator Overhaul Manual	523-0756910
331A-6D/6E/7/7A Course Indicator Overhaul Manual	523-0755793

51RV-2B VOR/ILS Receiver
Figure 1

51RV-2B VOR/ILS Receiver - Description and Operation

1. GENERAL.

This section presents the purpose, specifications, description, and general theory of operation of the 51RV-2B VOR/ILS Receiver. Refer to figure 1 for an overall view of the 51RV-2B. Figure 2 is a table of equipment covered in this manual.

EQUIPMENT	FREQUENCY	COLLINS PART NO.
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	522-4280-001
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	522-4977-001
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	777-1480-001

Equipment Covered
Figure 2

2. PURPOSE OF EQUIPMENT.

The 51RV-2B VOR/ILS Receiver receives VOR, localizer, and glideslope signals and provides outputs to operate deviation, standard flag, high power flag, and to/from indicators; the VOR pointer of an RMI (radio magnetic indicator); and the aircraft audio system..

When tuned to a VOR frequency, the 51RV-2B will operate with an external course indicator that provides a 400-Hz electrically zeroed course resolver. When installed in the aircraft, outputs are provided from the 51RV-2B to operate VOR deviation and to/from indicators, a VOR warning flag in the course indicator, an RMI VOR bearing pointer, and to supply an aural output.

When tuned to a localizer frequency, the corresponding glideslope frequency is automatically selected. Outputs are provided from the 51RV-2B to operate localizer and glideslope deviation indicators and ILS warning flags in the course indicator and to supply an aural output.

The 51RV-2B also provides VOR and ILS deviation and flag data as computer inputs for flight director and autopilot systems. Associated equipment that may be used with the 51RV-2B is listed in figure 3.

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
37P-4 Glideslope Antenna	522-0688-013	For use with single glideslope receiver, 0.7 lb (.32 kg)	Receives glideslope navigation signals (uhf).
37P-5 Glideslope Antenna	522-0700-003	For use with two glideslope receivers, 0.7 lb (.32 kg)	Receives glideslope navigation signals (uhf).
Type N coaxial	557-9040-00	UG-21B/U, 0.1 lb (.05 kg)	Antenna connector.
BNC-to-N adapter	357-9056-00	UG-201/U, 0.1 lb (.05 kg)	For use with 37P-4
137X-1 VHF NAV/ COMM Antenna	522-1136-000	Vhf antenna, 4.7 lb (2.13 kg)	Receives VOR/LOC navigation signals (vhf).
or			
37J-3 VHF Navigation Antenna	505-6800-00	Vhf antenna, 5.75 lb (2.61 kg)	
or			
837B-1 VOR/ LOC Antenna	758-5703-001	Vhf antenna, 2.6 lb (1.18 kg)	
313N-1 Control	522-2446-004	Remote control	Provides remote frequency, volume, and self-test control.
or			
313N-2 Control	522-2447-005	Remote control	
or			
313N-3 Control	522-2448-005	Remote control	
or			
313N-4B Control	522-3614-000	Remote control	
or			
313N-4D Control	522-3616-000	Remote control	
or			
313N-6B Control	522-3690-000	Remote control	

Associated Equipment (Sheet 1 of 2)
Figure 3

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
Flight director indicator or Approach horizon		Collins 329B-6( )/ 7( )/8( ) Collins 329B-4( ) or equivalent	Provides aircraft position with respect to glide-slope beam and computed lateral guidance steering information.
Course indicator		Collins 331A-4( )/ 6( )/7( ) or equivalent	Provides pictorial display of aircraft position with respect to localizer course or omni-range radio.
Radio magnetic indicator (RMI)	482-0061-00	Collins 332C-4 or equivalent	Provides magnetic heading and station bearing information.
390Y-1 Shock-mount	522-3060-00	Shockmount 1.7 lb (.77 kg)	Provides shock-mounting for the 51RV-2B.

Associated Equipment (Sheet 2 of 2)
Figure 3

3. EQUIPMENT SPECIFICATIONS.

The 51RV-2B VOR/ILS Receiver specifications are listed in figure 4.

CHARACTERISTIC	SPECIFICATIONS
General	
Size	ARINC Specification No. 404, 1/2-ATR short (including interconnect unit).
Weight	19.5 lb (8.84 kg).

Equipment Specifications (Sheet 1 of 6)
Figure 4

CHARACTERISTIC	SPECIFICATION
Design specifications	TSO C-34b, C-36b, and C-40a. Environmental category $\frac{A}{D}$ A $\frac{A}{B}$ AAAE ARINC Characteristic 547. FCC rules and regulations; part 15.
Environmental	
Temperature	
Continuous operation	-54 °C (-65.2 °F) to +55 °C (+131 °F).
Intermittent operation (30 minutes maximum)	Up to +71 °C (160 °F).
Storage	-65 °C (-85 °F) to +85 °C (+185 °F).
Humidity	95 to 100% at +50 °C (+122 °F) for 48 h.
Altitude	Up to 55,000 ft (16.77 km).
Shock	
51RV-2B in shockmount	15 g operating, 30 g impact (10 ms duration).
51RV-2B in rigid mount	6 g operating, 15 g impact (10 ms duration).
Vibration	
51RV-2B in shockmount	0.03 in (.08 cm) double amplitude, 5 to 55 Hz; 5 g, 55 to 500 Hz. 180 minutes in each of three planes as per RTCA paper 120-61/DO-108, category A.
51RV-2B in rigid mount	0.02 in (.05 cm) double amplitude, 5 to 55 Hz; 1.5 g, 55 to 500 Hz. 180 minutes in each of three planes as per RTCA paper 120-61/DO-108, category A.
Electrical Susceptibility	
Conducted audio	1.4 vrms from 200 to 20,000 Hz on +27.5-vdc power leads. 1.3 vrms from 800 to 9000 Hz on 26-vac, 400-Hz power leads.
Conducted rf interference	An rf signal which varies between 90 kHz to 30 MHz, modulated 30% at 1000 Hz with the rf level varying between 80 and 63 db above 1 uv per RTCA paper 120-61/DO-108.
Radiated rf interference	An rf signal which varies between 90 kHz to 1000 MHz, modulated 30% at 1000 Hz with the rf level varying between 63 and 93 db above 1 uv per RTCA paper 120-61/DO-108.

Equipment Specifications (Sheet 2 of 6)
Figure 4

CHARACTERISTIC	SPECIFICATION
Electrical (Cont)	
Cross modulation	
VOR/LOC and glideslope	Meets the following specifications: VOR: Per RTCA papers 225-55/DO-69 and 48-62/DO-114. LOC: Per TSO C-36b and RTCA paper DO-131. GS: Per TSO C-34b and RTCA paper DO-132.
Channel selection time	Not more than 1 second.
Power source	
Dc	+27.5 vdc +10% -20% with negative lead grounded.
Ac	26 vac, 380 to 420 Hz (instrument power).
Power requirements	
VOR	+27.5 vdc, 40 w; 26 vac, 400 Hz, 16 va.
ILS	+27.5 vdc, 40 w; 26 vac, 400 Hz, 16 va.
Frequency range	
VOR	108.00 to 117.95 MHz except odd tenths of MHz from 108.1 to 111.9 MHz.
LOC	108.1 to 111.9 MHz, odd tenths of MHz.
Glideslope	329.3 to 335.0 MHz.
Channel increments	
VOR	50 kHz.
LOC	200 kHz.
Glideslope	300 kHz.
Number of channels	
VOR	180.
LOC	20.
Glideslope	20.
Spurious	
1051B-1 VHF NAV Receiver	80 db down min.
951A-1 Glideslope Receiver	70 db below desired signal in the frequency range of 0.09 to 1500 MHz.

Equipment Specifications (Sheet 3 of 6)
Figure 4

CHARACTERISTIC	SPECIFICATION
Electrical (Cont)	
Selectivity	
1051B-1 VHF NAV Receiver	±25 kHz min bandwidth at 6 db; ±45 kHz max bandwidth at 60 db.
Sensitivity	
1051B-1 VHF NAV Receiver	
Audio channel	6-db s+n/n ratio for a 3-uv signal modulated 30 percent at 1000 Hz.
VOR channel	With a 3-uv standard VOR test signal as per RTCA paper DO-69, the indicator flag is fully masked, and satisfactory navigation performance is obtained.
951A-1 Glideslope Receiver	With a 2-db audio ratio and with the course sensitivity control adjusted for 78 ua, 47 ua are obtained on all channels with an input of not more than 5 uv.
Output circuits	
VOR/LOC crosspointer output	Five 1000-ohm loads; internal dummy loads; 150 ua/10 degrees VOR, 90 ua/4 db LOC.
Monitor VOR/LOC crosspointer output	Two 1000-ohm loads.
VOR/LOC flag output	Flag load can consist of up to four 1000-ohm loads in parallel. Dummy loads are not required.
To/from output	A dc output is provided for two parallel 200-0-200-ua ±20% meters each having 200 ohms ±15% internal resistance.
High power flag output	+27.5 vdc at 250 ma.
VOR accuracy	
Manual channel	
Standard conditions	Less than ±0.5 degree of azimuth runout error.

Equipment Specifications (Sheet 4 of 6)
Figure 4

CHARACTERISTIC	SPECIFICATION
Electrical (Cont)	
Service conditions	Within ±0.5 degree with 95% probability under max environmental conditions.
Automatic channel	Less than ±1.0 degree. RMI card servo-amplifier null width is less than ±0.5 degree.
VOR monitoring	
Automatic channel	Flag warning detects level drop of 6 db or 2-degree bearing error between the monitor channel and primary channel.
Manual channel	Flag warning detects level drop of 2 db or 1-degree bearing error between secondary channel and primary channel.
Frequency synthesizer	Flag warning detects synthesizer out of lock.
LOC accuracy	
Standard conditions	Less than ±2 ua centering.
Service conditions	Less than ±4 ua centering with 95% probability under max environmental conditions.
LOC monitoring	Flag warning detects the following: 1. Level drop of 2 db. 2. Centering error of 5 ua (adjustable) between the secondary channel and primary channel. 3. Frequency synthesizer out of lock.
Output circuits	
Glideslope deviation output	Five 1000-ohm loads in parallel. Internal dummy loads.
Glideslope flag output	Up to four 1000-ohm loads in parallel. Dummy loads are not required.
Glideslope high power flag output.	+27.5 vdc at 250 ma.

Equipment Specifications (Sheet 5 of 6)
Figure 4

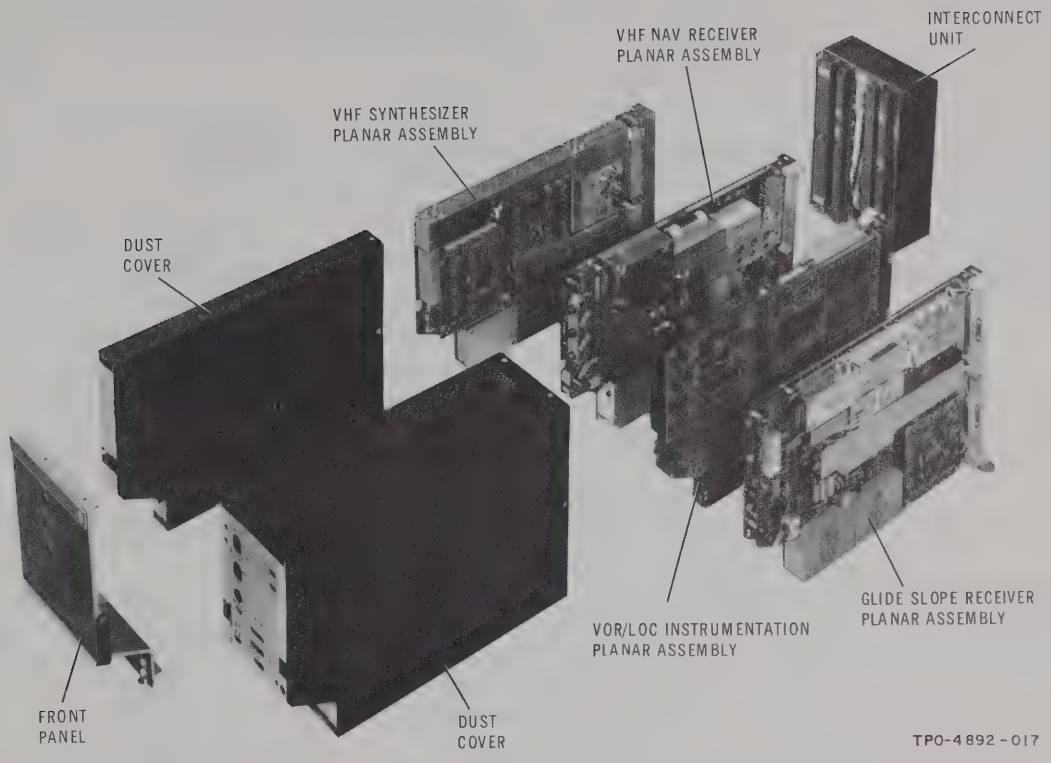
CHARACTERISTIC	SPECIFICATION
Electrical (Cont)	
Glideslope accuracy	
Linearity	A varying audio ratio from 0 to 4 db results in linear deflection sensitivity within 10% or 3 ua, whichever is greater.
Balance	When receiver is adjusted to provide 78 ua with a 700-uv deviation signal, with 90 Hz being greater than 150 Hz, the deviation of opposite polarity obtained when the signal is modulated with 150 Hz greater than 90 Hz is within 4% of 78 ua.
Centering	
Standard conditions	Less than ±3 ua.
Service conditions	Less than ±6 ua with 95% probability under max environmental conditions.
Glideslope monitoring	Flag warning detects the following: 1. Level drop of 2 db. 2. Centering error of 5 ua (adjustable) between the secondary channel and primary channel. 3. Frequency synthesizer out of lock.

Equipment Specifications (Sheet 6 of 6)
Figure 4

4. EQUIPMENT DESCRIPTION.

A. Mechanical Description. (Refer to figures 5 and 6.)

The 51RV-2B VOR/ILS Receiver consists of four planar assemblies and an interconnect unit. The planar assemblies are designated as the 1051B-1 VHF NAV Receiver Planar Assembly, 844A-1 VOR/LOC Instrumentation Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, and 680T-1 VHF Synthesizer Planar Assembly.



51RV-2B VOR/ILS Receiver, Planar Assembly Identification
Figure 5

UNIT	FUNCTION	COLLINS PART NO.
1051B-1 VHF NAV Receiver (with self-test audio generator and power supply)	Receives 108.00- to 117.95-MHz VOR/LOC signals (provides VOR/ILS self-test audio and +18- and +5-vdc power).	772-0790-001
844A-1 VOR/LOC Instrumentation	Processes VOR/and LOC signals to operate RMI, VOR/LOC deviation indicator, to/from indicator, and VOR/LOC flags.	757-0701-001
951A-1 Glideslope Receiver (with uhf synthesizer and glideslope instrumentation)	Receives 329.3- to 335.0-MHz glideslope signals (provides injection frequency to glideslope receiver and processes glideslope signals to operate glide-slope deviation indicator and glideslope flag).	757-0700-001

51RV-2B Planar Assemblies (Sheet 1 of 2)
Figure 6

UNIT	FUNCTION	COLLINS PART NO.
680T-1 VHF Synthesizer	Provides tuning voltage to 1051B-1 VHF NAV Receiver and injection frequency to 1051B-1 VHF NAV Receiver and to uhf synthesizer.	772-0738-001
Interconnect unit	Provides necessary interconnect wiring between four planar assemblies of a 51RV-2B. Also provides for direct interchange from 51RV-1 to 51RV-2B system. This interconnect unit is used with 51RV-2B, Collins part numbers 522-4280-001 and 522-4977-001.	772-0824-001
	Same function as above, only this interconnect unit has two wires removed, and is used with 51RV-2B, Collins part number 777-1480-001.	772-0824-002

51RV-2B Planar Assemblies (Sheet 2 of 2)
Figure 6

The 1051B-1 VHF NAV Receiver consists of a vhf tuner and an if. circuit, an audio amplifier, a VOR/ILS test generator, an RMI card servo amplifier, and a power supply. The 844A-1 VOR/LOC Instrumentation consists of dual primary and monitor channels for automatic VOR operation, dual primary and secondary channels for manual VOR operation, and a sensor used for both VOR and localizer operation. The 951A-1 Glideslope Receiver consists of a glideslope receiver, glideslope instrumentation consisting of dual primary and secondary channels, a sensor, and a uhf synthesizer. The 680T-1 vhf synthesizer consists of oscillators, mixers, and integrated logic circuits.

Each planar assembly has a planar sideboard with a Collins thin-line connector mounted rigidly to the planar sideboard. Parallel-mounted subassembly cards plug directly into the sideboards. This technique provides maximum space for component mounting while keeping the physical size to a minimum.

The 680T-1 VHF Synthesizer Planar Assembly is housed in an individual dust cover. Another dust cover houses the 1051B-1 VHF NAV Receiver Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, and 844A-1 VOR/LOC Instrumentation Planar Assembly. The planar assemblies slide into the dust covers from the rear. Each sideboard connector is attached to its dust cover. The front panel assembly is fastened to each planar assembly with a screw at the top and bottom of each ATR unit.

The 51RV-2B can be interchanged with the 51RV-1 when the interconnect unit is used. The interconnect unit is a 5-sided aluminum enclosure screw mounted on the rear of

the ATR units. It houses the mating connectors for the planar assemblies and the interconnect wiring, including the ARINC DPX2 connector.

Refer to figure 7 for a table of 51RV-2B connectors.

51RV-2B PLANAR ASSEMBLY CONNECTORS	PLANAR ASSEMBLY	INTERCONNECT UNIT MATING CONNECTORS
Collins part no. 777-0621	680T-1 VHF Synthesizer	Collins part no. 777-0622
Collins part no. 772-0626	1051B-1 VHF NAV Receiver	Collins part no. 772-0700
Collins part no. 768-9098	951A-1 Glideslope Receiver	Collins part no. 772-0699
Collins part no. 772-0718	844A-1 VOR/LOC Instrumentation	Collins part no. 772-0698
INTERCONNECT UNIT CONNECTOR	**FUNCTION**	**SHOCKMOUNT MATING CONNECTOR**
DPX-CA-32W2P57P-34B	51RV-2B interconnect from interconnect unit to shockmount	DPX2-CA-32W2S57S-33B

51RV-2B Connectors
Figure 7

B. Electrical Description.

(1) 680T-1 VHF Synthesizer Planar Assembly.

The vhf synthesizer converts 2-out-of-5 remote control information to binary coded decimal (BCD) information.

The digitally stabilized vhf synthesizer provides all of the required injection frequencies for the vhf NAV receiver first mixer, and front end tuning voltages for the bandpass filter preselector in the vhf NAV receiver. Injection frequencies and tuning voltages cover the 108.00- to 117.95-MHz VOR/LOC band in 50-kHz increments. The synthesizer consists of a logic converter, reference oscillator, and two related phase-locked loops. The vhf synthesizer also provides BCD information, injection frequencies and a 50-kHz reference frequency to the glideslope receiver planar assembly uhf synthesizer.

(2) 1051B-1 VHF NAV Receiver Planar Assembly.

(a) VHF Tuner and IF. Circuits.

The vhf tuner and if. circuits consist of a voltage variable capacitor tuned vhf front end followed by two if. amplifiers, a detector, and agc circuits. Tuning over the 108.00- to 117.95-MHz range is accomplished by the vhf injection and dc tuning voltages supplied by the vhf synthesizer. The mixer if. outputs are at 18 MHz and 498.5 kHz. The 18-MHz if. results from mixing the rf input with the VOR/LOC injection frequency from the vhf synthesizer. This 18-MHz signal is reduced to 498.5 kHz by mixing the 18 MHz with an 18.4985-MHz oscillator output. The 498.5-kHz if. is detected, and the output is applied to the VOR/LOC instrumentation input. The output is also applied to the audio amplifier for filtering and shaping to produce an aural output.

(b) Audio Amplifier.

The audio amplifier provides noise limiting, response shaping, and power amplification for the audio output from the vhf tuner and if. circuits. The aural output from the audio amplifier is applied to the aircraft cockpit audio system.

(c) VOR/ILS Audio Test Generator and Timer.

The VOR/ILS self-test audio generator synthesizes VOR and ILS audio signals that are applied to the self-test oscillators in each receiver. When the 51RV-2B is tuned to a localizer frequency (ILS mode), the test generator is energized by actuating the UP/L or DN/R test switches on the 51RV-2B front panel. In the VOR mode, the self-test is energized by actuating the VOR test switch on the 51RV-2B front panel. All self-test functions can also be initiated from a remote control unit per ARINC Characteristic 547.

(d) RMI Servo Amplifier.

The RMI servo amplifier receives low-level magnetic heading information from the magnetic compass system and amplifies this signal to a level sufficient to drive the RMI compass card.

(e) Power Supply.

The 51RV-2B power supply uses +27.5-volt dc aircraft power to provide the required +18- and +5-volt regulated dc power.

(f) VOR/LOC Mode Relay.

The VOR/LOC mode relay switches VOR power to the VOR circuit when the 51RV-2B is tuned to a VOR frequency, and ILS power to the ILS circuit when the 51RV-2B is tuned to a localizer frequency. When in the ILS mode, +27.5 volts dc is brought out to bottom plug pin 36 on the rear of the interconnect unit.

(3) 844A-1 VOR/LOC Instrumentation Planar Assembly.

(a) Primary VOR Instrumentation and Manual VOR Instrumentation.

The automatic or primary VOR instrumentation and the manual VOR instrumentation are series connected, thus providing complete fail-safe operation. The automatic VOR circuit provides an output to drive the RMI VOR bearing pointer for continuous VOR bearing. The manual VOR circuit provides VOR deviation and to/from outputs with respect to the pilot-selected OBS setting. Unless both automatic and manual VOR circuits are operating properly, a VOR flag will show. A VOR flag will also come into view if the monitor VOR instrumentation channel is not operating properly. Proper operation provides a 2-kHz, square-wave signal from both primary and monitor VOR instrumentation channels to energize the flag logic circuit and remove the VOR flag from view.

(b) Monitor VOR Instrumentation Channel.

The monitor VOR channel is identical to the automatic channel and also provides a 2-kHz, square-wave signal to energize the flag when the two channels track. The reference and variable 30-Hz signals provide inputs to the VOR level and null sensor in the monitor channel. These inputs must be in quadrature or the VOR flag will show.

(c) Localizer Instrumentation and Manual VOR/LOC Sensor.

The localizer instrumentation circuit consists of primary and secondary channels. The audio output from the vhf NAV receiver is applied to the localizer instrumentation, which operates when the 51RV-2B is in the ILS mode (localizer frequency selected). The 90- and 150-Hz components are separated in dual channels.

Each channel provides a deviation output either to operate the VOR/LOC pointer (primary channel) or for comparison monitoring in the manual VOR/LOC sensor (primary and secondary channels). Level outputs from the primary channel are also monitored in the level sensor of the manual VOR/LOC sensor. Any unreliable signals will cause loss of flag signal, and the VOR/LOC flag will show.

(d) VOR/LOC Flag Logic, Driver, and Power Flag.

The VOR/LOC flag logic, driver, and power flag provides CCCS flag, high power flag, and low level flag outputs to retract VOR/LOC flags from view when the vhf NAV receiver and instrumentation are functioning properly.

(4) 951A-1 Glideslope Receiver Planar Assembly.

(a) UHF Synthesizer.

The inputs to the uhf synthesizer consist of the vhf output of the vhf synthesizer, the 50-kHz reference signal from the frequency standard in the vhf synthesizer, and binary coded decimal (BCD) control information. The uhf

synthesizer produces the uniquely paired (with the localizer frequency) uhf glideslope injection frequencies for the glideslope receiver.

(b) UHF Tuner and IF. Circuits.

The uhf tuner and if. circuits consist of a fixed, tuned bandpass filter followed by if. amplifiers, a detector, and an agc circuit. The bandpass filter passes the frequency band 329.3 to 335.0 MHz. Injection from the uhf synthesizer through a tripler and into a first mixer provides a 30.1-MHz if. The 30.1-MHz if. is applied to the second mixer and if. amplifier to produce 500 kHz for detection. The resulting audio is applied as an input to the glideslope instrumentation.

(c) Glideslope Instrumentation and ILS Sensor.

The glideslope instrumentation circuit consists of primary and secondary channels. The audio output from the uhf tuner and if. circuits are applied to the glideslope instrumentation, which operates when the 51RV-2B is in the ILS mode. The 90- and 150-Hz components are separated in dual channels. The primary channel provides an output to operate the glideslope deviation pointer. Both channels produce deviation outputs for comparison monitoring in the ILS sensor. Rectified 90/150-Hz level outputs from the primary channel are monitored in the level sensor of the ILS sensor. Any unreliable signal from either the primary or secondary channel will cause loss of flag output, which causes the glideslope flags to show.

(d) Glideslope Flag Logic and Driver.

The glideslope flag logic and driver provides CCCS flag, high power flag, and low level flag outputs to retract glideslope flags from view when the glideslope receiver is functioning properly.

(5) Interconnect Unit.

With the interconnect unit connected to the 51RV-2B, the size of the unit conforms to ARINC Specification No. 404, 1/2 ATR short. The combined 51RV-2B and interconnect unit can be interchanged with the 51RV-1, provided the aircraft is wired for a 400-Hz system. The interconnect unit houses four mating connectors which mate with the Collins thin-line connectors on each planar assembly, and these vertical connectors are in turn connected to the DPX2 connector on the rear of the interconnect unit. The 51RV-2B DPX2 connector mates with the connector on the 390Y-1 Shockmount. A test connector on the interconnect unit provides access to various 51RV-2B functions as an aid in alignment and troubleshooting. In addition to the above, the interconnect unit, with Collins part number 772-0824-002, has the glideslope pointer bias connections deleted, and is used with the 51RV-2B, Collins part number 777-1480-001.

C. Controls. (Refer to figure 8.)

The dust cover that houses the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assemblies is designed to provide access to most adjustable controls in the 51RV-2B. Three of the adjustable controls are accessible through holes on top of the dust cover. The removal of the 51RV-2B front panel exposes all other adjustment controls except those listed as internal. All variable capacitors, coils, and filters (in the vhf and uhf tuners) are considered as alignment components, and are not listed in figure 8.

The adjustable controls are listed in figure 8. Controls are listed by planar assemblies of the 51RV-2B.

CONTROL	LOCATION	FUNCTION
1051B-1 VHF NAV Receiver		
AUD LVL (R6)	External	Controls signal level applied to audio amplifier.
VOR TEST (S1)	Front panel	Initiates VOR self-test of 51RV-2B.
LOC BAL (R70)	External	Controls 90/150-Hz tone ratio of composite localizer self-test signal.
LOC LVL (R79)	External	Controls level of composite localizer test signal applied to vhf NAV receiver.
VHF DET (R9)	External	Controls output level of detected vhf signal.
UP/L (S2)	Front panel	Initiates ILS up/left self-test of 51RV-2B.
GS BAL (R75)	External	Controls 90/150-Hz tone ratio of composite glideslope self-test signal.
GS LVL (R78)	External	Controls level of composite glideslope test signal applied to glideslope receiver.
DN/R (S3)	Front panel	Initiates ILS down/right self-test of 51RV-2B.
VOR ZERO (R33)	External	Controls phase relationship between 30-Hz amplitude modulation and 30-Hz frequency modulation of 9960-Hz VOR self-test signal.

51RV-2B Adjustment Controls (Sheet 1 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
30 HZ LVL (R86)	External	Controls level of the 30-Hz signal which modulates the 9960-Hz multivibrator output.
900 FREQ (R5)	External	Controls the frequency of the 900-Hz multivibrator output.
9960 FREQ (R27)	External	Controls the frequency of the 9960-Hz multivibrator output.
20.2V (R14)	Internal	Controls output voltage of preregulator in +18- and +5-volt dc power supply.
18.0V (R29)	Internal	Controls output voltage of +18-volt dc regulator.
680T-1 VHF Synthesizer		
16-volt regulator (R1)	Internal	Controls output voltage of +16-volt dc regulator.
844A-1 VOR/LOC Instrumentation		
Localizer circuit controls		
PRI CTR (R257)	External	Controls centering of the primary deviation.
PRI SENS (R201)	External	Controls the primary deviation sensitivity.
SEC CTR (R260)	External	Controls centering of the secondary deviation.
SEC SENS (R221)	External	Controls the secondary deviation sensitivity.
VOR circuit controls		
PRI ZERO (R14)	External	Calibrates automatic VOR channel for zero degree VOR bearing indication with a standard VOR test signal.
PRI TRACK (R166)	External	Controls azimuth tracking error of automatic VOR channel.

51RV-2B Adjustment Controls (Sheet 2 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
MON ZERO (R134)	External	Calibrates monitor VOR channel for zero-degree VOR bearing indication with a standard VOR test signal.
MON TRACK (R186)	External	Controls azimuth tracking error of automatic VOR channel.
SENS (R252)	External	Controls manual VOR primary and secondary deflection sensitivity.
BAL (R245)	External	Controls manual VOR primary and secondary deflection sensitivity balance.
RATE (R310)	External	Controls amount of rate feedback to servo amplifier.
Sensor circuit controls		
LOGIC DET (R40)	External (through top of dust cover)	Controls amplitude of 50-kHz signal used in manual VOR/LOC sensor.
GATE WID (R38)	External (through top of dust cover)	Controls manual VOR/LOC deviation difference sensor gate width.
FLAG THRESHOLD (R70)	External (through top of dust cover)	Controls manual VOR/LOC level sensor triggering threshold.
951A-1 Glideslope Receiver		
PRI SENS (R11)	External	Controls primary deviation sensitivity.
SEC SENS (R21)	External	Controls secondary deviation sensitivity.
PRI CTR (R41)	External	Controls centering of the primary deviation.
SEC CTR (R45)	External	Controls centering of the secondary deviation.

51RV-2B Adjustment Controls (Sheet 3 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
LOGIC DET (R40)	External	Controls amplitude of 50-kHz signal used in ILS sensor.
GATE WID (R38)	External	Controls amplitude of glideslope deviation difference sensor gate width.
FLAG THRESHOLD (R70)	External	Controls glideslope level sensor triggering threshold.

51RV-2B Adjustment Controls (Sheet 4 of 4)
Figure 8

5. THEORY OF OPERATION

A. General.

The theory of operation includes ground facilities operation, 51RV-2B simplified block diagram theory, and the 51RV-2B detailed block diagram theory.

The 51RV-2B detailed block diagram theory is subdivided for each planar assembly (see paragraphs 5.D.(2) through 5.D.(5)). Paragraph 5.D.(1) discusses the general theory of operation of the 51RV-2B VOR/ILS Receiver, with emphasis on monitoring techniques.

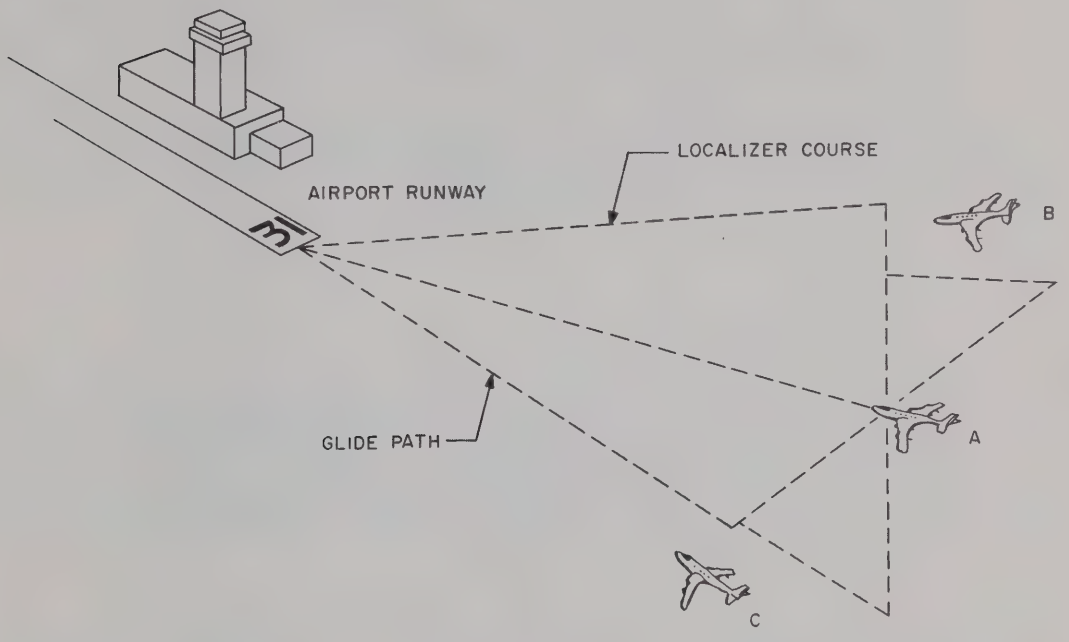
B. Theory of Ground Facilities.

(1) ILS Principle.

(a) Radiation Pattern.

Two separate ground radio systems radiate the glideslope and localizer patterns by complex antenna arrays located near the airport runway. The glideslope signal (329.3 to 335.0 MHz) is radiated to produce effectively two intersecting lobes, one above the other. The upper lobe is predominantly modulated with 90 Hz, and the lower lobe is predominantly modulated with 150 Hz. On a line at an angle of 2.5 to 3 degrees from the ground, the two audio signals are equal. This line of equal modulation defines the glide path and is shown by the horizontal plane in figure 9. The 51RV-2B detects and compares the 90 and 150 Hz and applies outputs to the glideslope deviation indicator and flag alarm on the course indicator. This provides vertical guidance for the pilot when making an approach to the runway. During an approach to the runway, the pilot receives horizontal guidance from the localizer deviation indicator and flag alarm on the course indicator. The 51RV-2B detects and compares two audio signals radiated by the localizer antenna array and provides an output to the course indicator. Two

intersecting lobes are produced effectively, and each is directed along one side of the runway. The lobe to the left is predominantly modulated with 90 Hz, and the lobe to the right is predominantly modulated with 150 Hz. The two audio signals are equal along a line bisecting the extended center line of the runway. The line of equal modulation defines the localizer course and is shown by the vertical plane in figure 9.



331A-6A COURSE INDICATOR

Localizer and Glideslope Operation, Pictorial Diagram
Figure 9

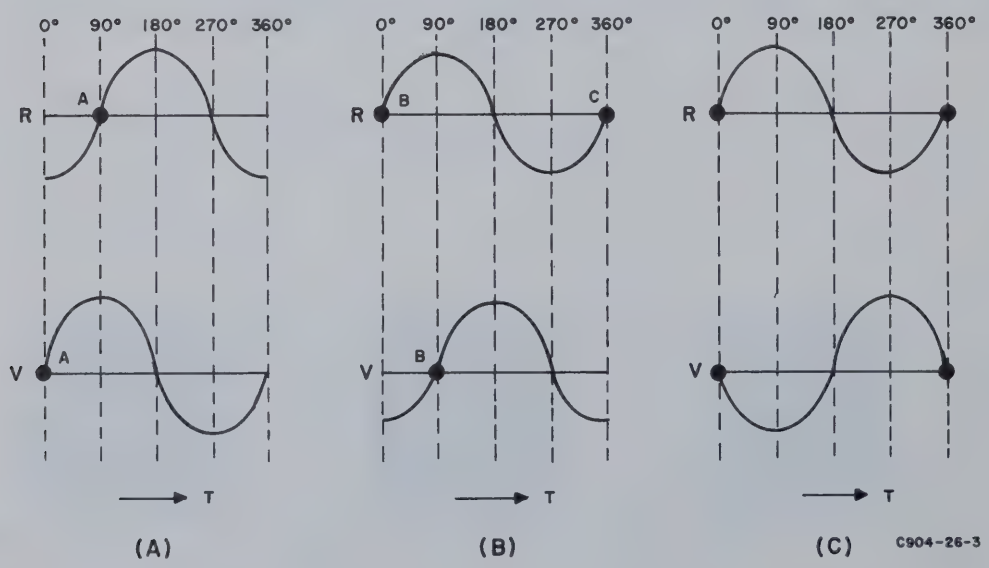
(b) ILS Operation. (Refer to figure 9.)

Audio signals of equal modulation are received and compared by the glide-slope and localizer receivers when the aircraft is flying on the intersecting lines of the horizontal (glide path) and vertical (localizer) planes. The glide-slope and localizer deviation indicators are centered by the receiver outputs as shown for the aircraft at position A. When the aircraft is to the right of the localizer course, a stronger 150-Hz signal will be detected, providing an output to deflect the localizer deviation needle to the left. The glideslope deviation needle will deflect down when the aircraft is above the glide path where the 90-Hz signal is stronger. The instrument for the aircraft at position B illustrates the above conditions. The localizer deviation needle will deflect to the right and the glideslope deviation needle will deflect up when the aircraft is at position C, where the localizer 90-Hz signal is stronger and the glideslope 150-Hz signal is stronger.

(2) VOR Principle.

(a) Sine Wave Comparison.

Sine waves will be used to illustrate the radiation of the VOR audio signals and to compare the phase differences of the two audio signals (30 Hz) in the 51RV-2B. Figure 10 illustrates how the phases of the audio signals are compared. At point (A) in figure 10, signal V passes through the reference line in a positive direction 90 degrees before signal R. In this condition, V is said to be leading R by 90 degrees.



Sine Wave Comparison, Simplified Diagram
Figure 10

Signal R is leading signal V by 90 degrees in figure 10(B) (note points B). If point C of signal R is compared with point B of signal V, signal R will be lagging by 270 degrees. From this comparison we note that one signal will lead another signal by an X number of degrees or lag by X + 180 degrees. The relationship will be determined by the points compared on the reference line. Figure 10(C) illustrates signals R and V when they are 180 degrees out of phase. Either signal is leading or lagging the other by 180 degrees.

(b) VOR Radiation Pattern.

1. General.

An understanding of the VOR ground radio system and radiation pattern will aid in understanding the operation of the 51RV-2B VOR circuits. The VOR system includes a ground station, an aircraft receiver, and associated instruments. VOR is an aircraft navigation aid that enables a pilot to determine the aircraft's bearing and azimuth as related to the ground station.

The principal of VOR navigation is phase comparison between a reference phase and a variable phase signal generated by the VOR transmitter and usually radiated by a 5-element antenna array. The phase difference is directly related to bearing. The VOR system is also used for communications. The ground station provides voice transmission and an identifying code to ensure that the desired VOR station is being monitored.

The VOR ground station transmits an infinite number of radials that can be received by the 51RV-2B. The deviation output of the receiver, proportional to the deviation from a selected radial, is applied to a course indicator. Additional receiver output signals energize to/from flag circuits that aid the pilot in determining whether the aircraft is flying to or from the ground station as related to the selected radial.

2. Reference Phase Signal.

The reference phase signal includes an rf carrier and a 9960-Hz subcarrier. The subcarrier is frequency modulated between 10,440 Hz and 9480 Hz at a rate of 30 Hz. The reference phase signal is radiated from the center antenna of the 5-element antenna array. This signal is omnidirectional and has a constant phase throughout 360 degrees of azimuth. When voice communication or station identification is transmitted, the FM subcarrier of the reference phase signal is amplitude modulated.

3. Variable Phase Signal.

The variable phase signal is a pure rf carrier. This signal is radiated by the diagonal antennas of the 5-element array. The field strength pattern is a figure eight configuration that is rotated through 360 degrees of azimuth at a rate of 1800 r/min. The phase of the signal varies directly with azimuth.

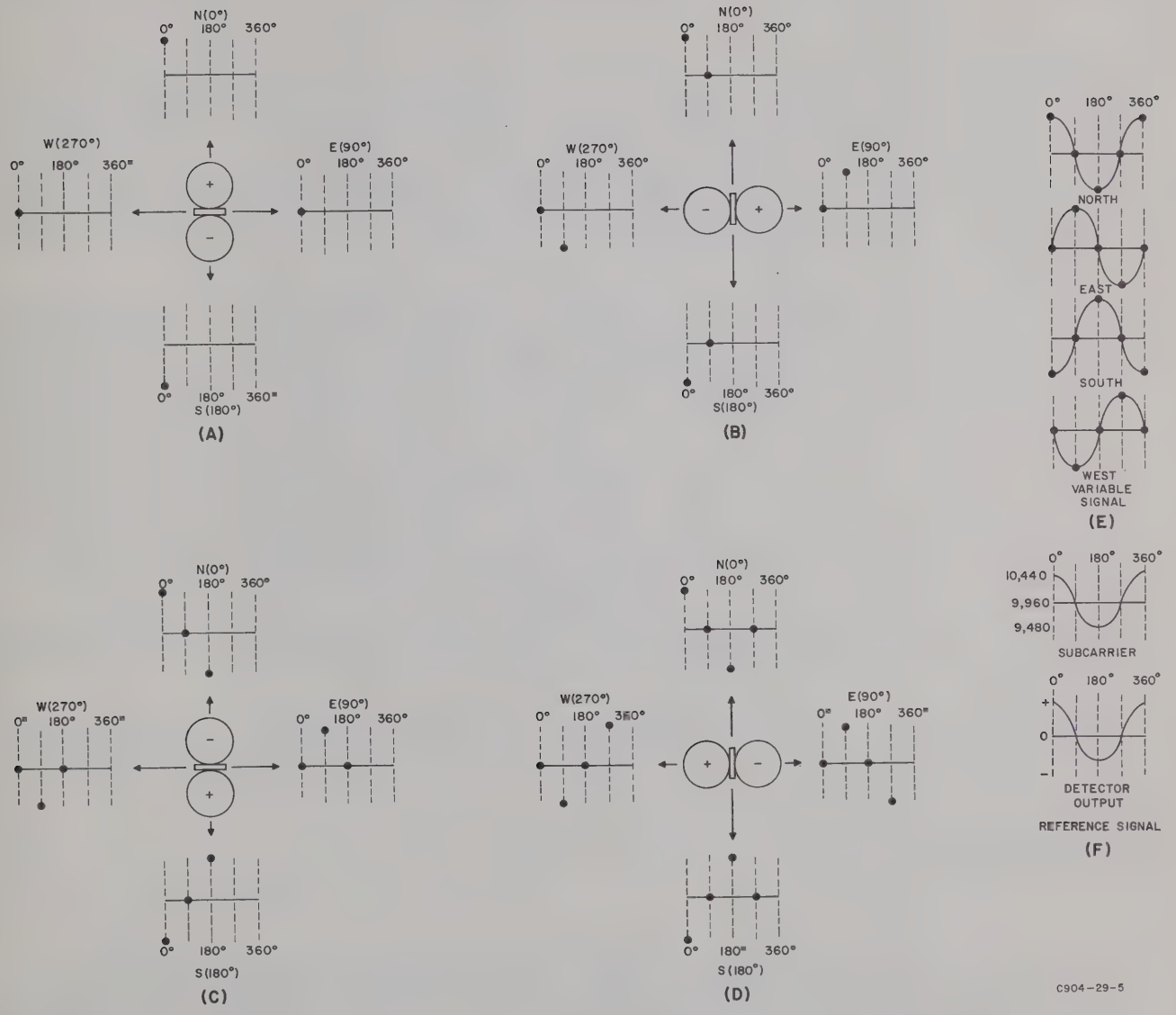
4. Composite Signal.

The reference phase signal and the variable phase signal are in phase when the positive lobe of the figure eight pattern is aligned with magnetic north. However, as the positive lobe of the variable phase signal is rotated through 360 degrees, the phase angle between the reference phase signal and the variable phase signal increases. When the variable phase signal is aligned other than magnetic north, the positive voltage maxima of the variable phase signal occurs at a given time later than the positive voltage maxima of the reference signal. The phase displacement in the 2-voltage maxima at any point in azimuth designates the bearing at that point. The difference in phase can be measured and indicated by instrumentation in the aircraft. Therefore, a radial can be selected, and the aircraft's flight path can be related to that selected radial.

The figure eight pattern reinforces the omnidirectional field strength pattern on the in-phase side and weakens the field strength on the out-of-phase side. The resultant field strength pattern is cardioid revolving at a rate of 30 r/s. As a result of the space modulation of the rotating cardioid, an additional 30-Hz signal is apparent at the receiver input. The receiver circuit detects what appears to be a 30-Hz frequency-modulated signal with a 30-Hz amplitude-modulated component. The phase of the two 30-Hz signals are compared, and the signal output is proportional to the phase relationship of the two 30-Hz signals.

5. VOR Signal Generation. (Refer to figure 11.)

The variable 30-Hz signal is obtained by transferring the rf carrier to a dipole antenna and rotating the antenna at a rate of 1,800 r/min (30 r/s). The radiation field of a dipole is a figure eight with the lobes 180 degrees out of phase. The field strengths at four directions (90-degree locations) from the antenna will be as shown by the black dots in figure 11(A) for one position of the dipole antenna. The relative strength of the radiated rf field is shown for this position, indicating maximum strength at 0 degree (north), minimum strength at 180 degrees (south), and an average strength (on reference line) at 90 and 270 degrees (east and west). The dots indicating field strength are placed on a graph depicting time versus signal strength. Vertical lines are added along the time axis to illustrate time for one-quarter cycle (90 degrees). Figure 11(B) illustrates the field strength with the dipole antenna rotated clockwise 90 degrees from the position shown in figure 11(A) (one-quarter turn). Relative strength at the north and south locations are now average and are shown on the graph at a time 90 degrees later. Maximum signal strength is plotted at 90 degrees (east), and minimum signal strength is plotted at 270 degrees (west). The field strength plotted in figure 11(C) is for the pattern of the dipole antenna rotated another 90 degrees (180 degrees from the position shown in figure 11(A)). The average signal strength is plotted on the reference line at 90 and 270 degrees (at a time 180 degrees later), maximum positive signal strength is plotted at



VOR Radiation Patterns, Simplified Diagram
Figure 11

180 degrees (south), and maximum negative signal strength is plotted at 0 degree (north). The field strength plotted in figure 11(D) is shown for the antenna rotated another 90 degrees (270 degrees from the position in figure 11(A)). When the antenna has been rotated 360 degrees, the signal strengths will be the same as those shown in figure 11(A) and advanced 360 degrees along the time axis. Figure 11(E) illustrates the voltage waveform of the signal strength plots at each direction from the station.

Since the dipole antenna is rotated at a rate of 1,800 r/min (30 r/s), these signal strengths (figure 11(E)) will vary at a 30-Hz rate and effectively amplitude-modulate the rf carrier. Note that the 30-Hz signal located 90 degrees from the VOR station lags the signal at the 0-degree location by 90 degrees. The phase of the signal continues to lag the signal north of the station by the number of degrees equal to the bearing from the station.

The phasing of the reference and variable signals is adjusted so they are in phase at magnetic north. The frequency of the 9960-Hz subcarrier is frequency modulated between 9480 and 10,440 Hz at a 30-Hz rate and is synchronized with the rotation of the dipole antenna. When the frequency of the subcarrier is 10,440 Hz, the positive lobe of the dipole antenna is pointed toward magnetic north. The subcarrier frequency decreases to 9480 Hz as the dipole antenna rotates clockwise to 180 degrees (south). At 90 and 270 degrees from north (0 degree), the subcarrier frequency is 9960 Hz. A maximum positive audio modulating voltage produces 10,440 Hz, and a maximum negative voltage produces 9480 Hz. Thus the output of an FM detector will be positive when the frequency is 10,440 Hz and negative when the frequency is 9480 Hz. The frequency of this voltage will be equal to the rate the subcarrier frequency is varying, which is 30 Hz.

The subcarrier frequency and the output voltage from an FM discriminator are shown in figure 11(F) for one cycle (one revolution of dipole antenna).

(c) VOR Operation.

1. General.

It was illustrated in the preceding paragraph that the phase angle between the reference and variable signals is a measure of the bearing of the aircraft from the VOR station. The 51RV-2B VOR instrumentation circuit measures this phase angle by providing a means to shift the reference signal after it has been demodulated from the 9960-Hz subcarrier. If it were practical to determine when two signals were in phase, the phase angle could be determined by shifting the reference signal until it was exactly in phase with the variable signal. Then the amount the reference signal was shifted would be a measure of the bearing from the station and could be indicated on any scale or dial coupled

to the phase-shifting device. Since it is much simpler to determine when two signals are 90 degrees out of phase, the reference signal is shifted an amount equal to the variable signal plus 90 degrees. The scale or dial is coupled to the phase-shifting device in such a manner that the extra 90 degrees of phase shift is not indicated.

2. Automatic VOR Operation.

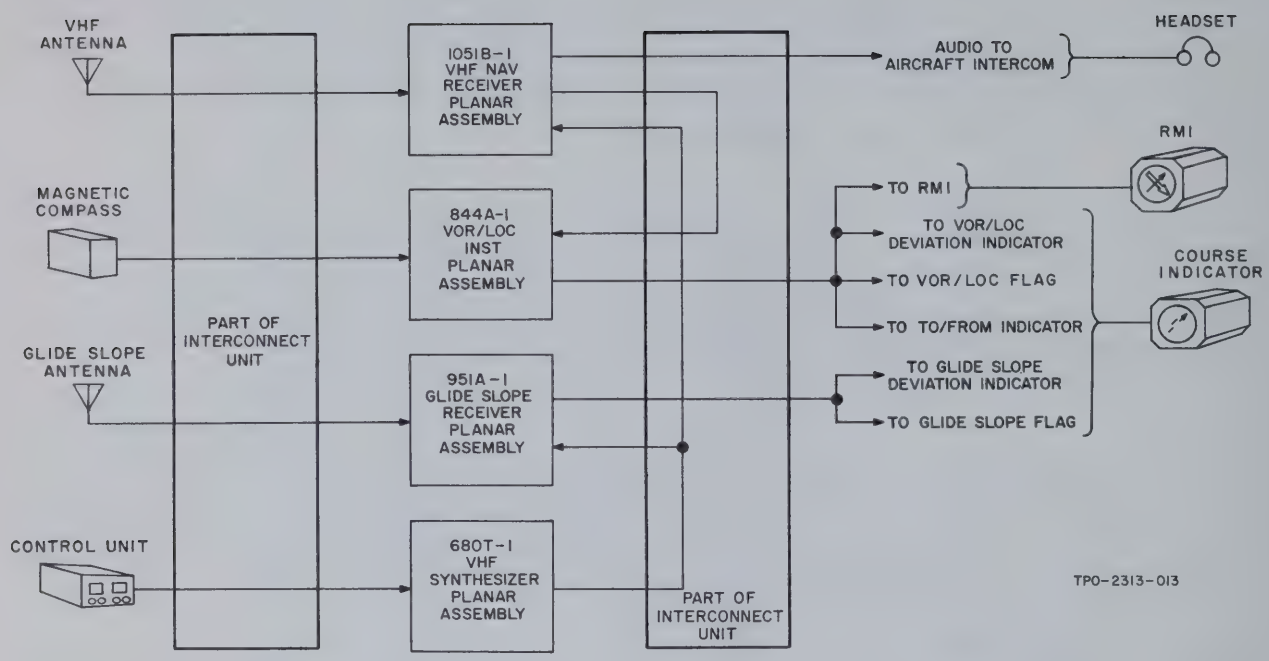
Automatic VOR operation is the term given when the 30-Hz reference signal is shifted automatically to measure the phase angle between the variable 30-Hz and reference 30 Hz. The phase difference between the reference and variable signals is detected in a phase detector. The phase detector output is converted to an ac voltage and amplified to drive a bearing mechanism motor. The motor turns the variable phase shifter and a synchro, which drives an RMI pointer. The motor will turn until it has shifted the reference signal in the phase shifter to obtain a 90-degree phase relationship with the variable signal in the VOR phase detector. At this time the phase detector output will be zero, and the motor will stop, positioning the RMI pointer at the bearing to the VOR station. A continuous indication of the bearing to the VOR station will be shown on the RMI.

3. Manual VOR Operation.

Manual VOR operation is the term used to describe the pilot's operation of the omnibearing selector (OBS) in the external course indicator. The VOR bearing mechanism motor rotates a 400-Hz resolver. Power is applied to the rotor of the resolver, inducing a voltage in the stators. This voltage is applied to the stator of a resolver in the external course indicator. The angular position of the rotor of this resolver is selected by the pilot when entering a course on the course indicator or OBS. If the course selected in the course indicator corresponds with the VOR bearing set by the motor shaft, the voltage induced in one of the resolver rotors of the course indicator will be zero volt, and the deviation indicator will provide an on-course indication. If the course selected in the course indicator does not correspond with the VOR bearing set by the motor shaft, the deviation indicator will provide the appropriate left or right indication.

C. 51RV-2B Simplified Block Diagram Theory. (Refer to figure 12.)

The 51RV-2B VOR/ILS Receiver consists of a 1051B-1 VHF NAV Receiver Planar Assembly, 844A-1 VOR/LOC Instrumentation Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, 680T-1 VHF Synthesizer Planar Assembly, and an interconnect unit. All interconnecting between the 51RV-2B planar assemblies is provided by the interconnect unit. The interconnecting between planar assemblies is accomplished by wiring from the pin on the mated vertical connector of one planar assembly to the appropriate pin on the mated vertical connector of another planar assembly. This wiring is contained inside the interconnect unit, which houses the four mating vertical connectors. All inputs to the planar assemblies and outputs from the planar assemblies are applied through the rear connector of the interconnect unit.



51RV-2B VOR/ILS Receiver, Simplified Block Diagram
Figure 12

The 680T-1 VHF Synthesizer provides tuning voltages and injection frequencies to the 1051B-1 VHF NAV Receiver, and BCD information, injection frequencies and a 50-kHz reference signal to the uhf synthesizer in the 951A-1 Glideslope Receiver. The 1051B-1 VHF NAV Receiver processes VOR and localizer rf to produce audio for the 844A-1 VOR/LOC Instrumentation and audio for an aural output. The 844A-1 VOR/LOC Instrumentation processes the detected audio from the 1051B-1 VHF NAV Receiver and applies a VOR/LOC deviation output to the course indicator, a VOR/LOC low-level and high power flag output to the course indicator, a continuous VOR bearing output to the RMI, and a to/from output to the course indicator. The 951A-1 Glideslope Receiver processes incoming glideslope rf and applies a glideslope deviation output and a low-level and high power flag output to the course indicator. VOR/LOC and glideslope deviation and flag outputs are also available for use with an automatic flight control system. VOR circuit is energized when the 51RV-2B is in VOR mode (108.00 to 117.95 MHz except odd-tenths MHz from 108.10 to 111.90 MHz). Localizer and glideslope circuits are energized when the 51RV-2B is in ILS mode (odd-tenths MHz from 108.10 to 111.90 MHz).

D. 51RV-2B Detailed Block Diagram Theory.

(1) General.

The 51RV-2B VOR/ILS Receiver provides manual and automatic VOR, localizer, and glideslope functions. The ILS accuracy monitoring capability of the 51RV-2B

meets all stated or anticipated category III landing requirements. In addition to ILS monitoring, extensive and thorough VOR monitoring, including accuracy monitoring, is incorporated within the 51RV-2B.

The 51RV-2B employs 2-out-of-5 binary switching for frequency selection. The ARINC 2-out-of-5 information is converted to binary coded decimal (BCD) information in a portion of the vhf synthesizer planar assembly circuit and is then applied to the vhf synthesizer offset control logic. The digitally stabilized frequency synthesizer uses only one crystal to provide all of the required injection frequencies. Glideslope and localizer pairing is accomplished automatically. The 51RV-2B provides 180 VOR channels with 50-kHz spacing in the frequency range 108.00 to 117.95 MHz, excluding odd tenths of megahertz in the 108.10- to 111.90-MHz frequency range. Twenty localizer channels are provided at odd tenths of megahertz in the 108.10- to 111.90-MHz frequency range. Twenty glideslope channels are available with 300-kHz spacing from 329.3 to 335.0 MHz.

The detected audio from the receivers is processed in the respective instrumentation circuit to provide VOR/LOC and glideslope deviation signals, flag outputs, to/from outputs, and an aural output. A continuous VOR bearing input to one of the RMI pointers is provided by the automatic VOR instrumentation. Magnetic heading information from the magnetic compass is amplified in the RMI servo amplifier to drive the RMI compass card. An output representing aircraft deviation (on-course or right or left) from a pilot-selected VOR bearing is provided by the manual VOR instrumentation. This output operates a VOR deviation bar in the course indicator.

The 51RV-2B VOR/ILS Receiver utilizes dual instrumentation channels with comparison to provide accuracy monitoring. The glideslope, manual VOR, and localizer instrumentation circuits each have primary and secondary channels which are identical to each other. The primary and secondary channels of the glideslope instrumentation circuit are identical to the primary and secondary channels of the localizer instrumentation circuit. The VOR primary channel contains the automatic VOR instrumentation and is monitored by an identical VOR monitor channel.

The ILS deviation outputs required to drive the deviation bars in the course indicator are taken from the glideslope and the localizer primary channels. The VOR deviation output is taken from the VOR primary channel deviation discriminator in the manual VOR instrumentation.

The deviation output of the glideslope primary channel is applied as an input to a comparator in the ILS sensor. The deviation output of the localizer primary channel is applied as an input to a comparator in the manual VOR/LOC sensor. The ILS sensor, like the manual VOR/LOC sensor, consists of level sensor, comparator, and threshold modifier. The ILS sensor is identical to the manual VOR/LOC sensor.

The secondary channels in the glideslope and localizer instrumentation unit also provide deviation outputs to the respective sensors. These secondary channel deviation outputs are not applied to the course indicator but are used only for comparison.

The primary channel in the glideslope instrumentation unit also provides two dc level outputs. One of the level outputs is a rectified 90-Hz signal and the other level output is a rectified 150-Hz signal. Each of the level outputs is applied to the level sensor in the ILS sensor.

The primary channel in the localizer instrumentation unit also provides rectified 90- and 150-Hz level outputs to the level sensor in the manual VOR/LOC sensor.

The ILS sensor, like the manual VOR/LOC sensor will provide a 2-kHz output to the respective flag logic circuit when both the level outputs and the deviation outputs are reliable. Any component failure in either the ILS sensor or VOR/LOC sensor will cause loss of the 2-kHz flag signal, and the respective glideslope or VOR/LOC flag will show.

The VOR primary channel consists of automatic VOR instrumentation. The manual VOR instrumentation circuit includes primary and secondary deviation discriminators and a to/from discriminator. A continuous VOR bearing output to the RMI is provided by the differential synchro in the automatic instrumentation. This servo motor also drives a 400-Hz resolver in the manual VOR instrumentation. This 400-Hz resolver is electrically coupled to the resolver in the course indicator. The omnibearing selector (OBS) is mechanically coupled to the course indicator resolver. If the OBS setting corresponds to the VOR bearing set by the motor shaft, the resolver in the course indicator will not apply voltages to the deviation discriminators in the manual VOR instrumentation. The VOR deviation output from the primary deviation discriminator in the manual VOR instrumentation will center the deviation needle for an on-course indication. If the OBS setting does not correspond to the VOR bearing, the resolver in the course indicator will apply voltages to the deviation discriminators in the manual VOR instrumentation. The primary deviation discriminator output will drive the deviation bar to the correct left or right indication.

An output from the to/from discriminator is applied to the to/from indicator. The to/from ambiguity indicator indicates whether the deviation to the VOR station is within the semicircle centered about the radial selected on the course selector (OBS) or within the semicircle centered about the reciprocal of the selected course direction. If the station direction is within 90 degrees of the selected radial, a "to" indication appears. If the station direction is within 90 degrees of the reciprocal of the selected radial, a "from" indication appears.

The VOR primary and secondary deviation discriminators in the manual VOR instrumentation circuit provide deviation outputs that correspond to the outputs of the deviation discriminators in the localizer instrumentation circuit. The outputs from the VOR discriminators are applied to the manual VOR/LOC sensor to provide complete monitoring of the primary VOR instrumentation. To complete the fail-safe VOR monitoring, a monitor VOR channel identical to the primary VOR channel is provided. This monitor channel does not provide deviation outputs. The VOR monitor channel functions only as a monitor to check the operation of the VOR primary channel. If either the VOR primary or monitor channel fails, the VOR/LOC flag will come into view.

(2) 680T-1 VHF Synthesizer Planar Assembly, Block Diagram Theory.

(a) General. (Refer to figure 13.)

The vhf synthesizer is capable of supplying output frequencies in the 116.000- through 135.975-MHz range in 25-kHz increments.

In the 51RV-2B, the vhf synthesizer supplies a 126.00- to 135.95-MHz output to the VOR/LOC receiver, thereby reducing the incoming rf (108.00 to 117.95 MHz) to the first if. 18-kHz difference frequency. The VOR/LOC receiver 50-kHz channel spacing requires the vhf synthesizer injection frequencies to be selectable at 50-kHz intervals. The vhf synthesizer injection frequency (126.1 to 129.9 MHz) applied to the uhf synthesizer is selected at 100-kHz intervals.

The accuracy and stability of each output frequency is equal to that of the crystal oscillator output in the frequency standard. A digitally stabilized master oscillator provides these output frequencies.

The vhf synthesizer in the 51RV-2B incorporates circuits which convert the 2-out-of-5 frequency information to binary coded decimal (BCD) information.

(b) Power Sources. (Refer to figure 13.)

The required +5- and +18-volt dc power is supplied directly from the +18/5-volt dc regulator in the 1051B-1 VHF NAV Receiver Planar Assembly. The +18-volt dc output from this regulator is applied to the +16-volt dc regulator in the vhf synthesizer. This regulator provides the +16 volts required for operation of the remaining circuits in the vhf synthesizer.

(c) Frequency Standard. (Refer to figure 13.)

The frequency standard consists of a temperature-compensated crystal oscillator (tcxo), buffer amplifiers, and a divider network. The tcxo consists of a 3.2-MHz, crystal-controlled oscillator and a temperature compensation network. The 3.2-MHz output is applied to the divider network through buffer amplifier Z5Q2 and pulse shaper Z4Q1. The divider network supplies two 25-kHz reference outputs (200-nanosecond and 5-microsecond pulse widths) to the vhf synthesizer and a 50-kHz reference output to the 51RV-2B uhf synthesizer.

(d) Synthesizer Operation. (Refer to figure 13.)

The operating frequency of the vcmo (vhf synthesizer rf output) is determined by a tuning voltage that is applied to voltage variable capacitors in the vcmo tuned circuit. This tuning voltage is supplied from an adder stage through a low-pass filter. Tuning voltage outputs from two phase-locked loops are combined in this adder. The tuning voltage from the 1-MHz phase-locked loop controls the vcmo operating frequency in 1-MHz increments, while the tuning voltage from the 25-kHz loop controls the operating frequency in 25-kHz increments.

Voltage-controlled oscillator (vco) Z43Q1, Z43Q2 provides the operating frequency for the 1-MHz phase-locked loop. Its output is supplied through buffer-amplifier Z40Q1 and pulse shapers Z6Q9 through Z6Q10 to a fixed divider. This network divides the vco output by 20. The output of the divide-by-20 network is supplied to the variable counter. The division ratio of this counter can be one of 20 ratios from 103 to 122. The division ratio is determined by information on the 1- and 10-MHz tuning wires. The variable counter output frequency is compared in a flip-flop phase detector with the 25-kHz reference frequency. The phase detector output is supplied to limiter-amplifiers Z6Q6 through Z6Q8. This stage supplies a tuning voltage through a low-pass filter to voltage variable capacitors in the vco tuned circuit.

When the two divider networks reduce the vco output frequency to 25 kHz, the phase detector supplies a tuning voltage that locks (holds) the vco on this frequency. This tuning voltage is also supplied through the adder network and low-pass filter to the vcmo tuned circuit. Since the division ratio of the counter is changed by 1 for each 1-MHz change in frequency information, the vcmo output frequency is changed in 1-MHz increments. The vco operating frequency is changed in 0.5-MHz increments.

NOTE: When the variable counter provides a division ratio of 103, the vco output is 51.5 MHz

$$\left[\frac{(51{,}500 \text{ kHz})}{(20)\ (103)} \quad \text{equals } 25 \text{ kHz}\right]$$

Then if the division ratio is increased to 104, the vco output will be 52.0 MHz.

The vco output is also supplied through buffer-multipliers Z38Q1 through Z39Q1 to mixer Z9Q1. The multiplier doubles the vco frequency. Therefore, the input to the mixer, that is derived from the vco, is in 1-MHz increments. The other input to the mixer is supplied from the vcmo through four buffer-amplifiers (Z34Q1, Z35Q1, Z36Q1, and Z37Q1). Both inputs to the mixer change in 1-MHz increments; therefore, the whole-megahertz difference between the mixer inputs is always the same.

The mixer output, in the 13.000 through 13.975-MHz range, is the operating frequency for the 25-kHz phase-locked loop. This output is supplied through a low-pass filter and pulse shaper stages (Z9Q2 through Z9Q4) to the variable counter. The division ratio of this counter can be one of 40 ratios from 520 to 559. This division ratio is determined by the information on the 25- and 100-kHz tuning wires. The variable counter output is compared with the 25-kHz reference in frequency and phase detectors. These detectors supply outputs through the loop control ANDing network to limiter-amplifiers Z9Q14 through Z9Q15. The limiter-amplifier supplies

a tuning voltage through the adder network and low-pass filter to the vcmo. When the mixer output is reduced to 25-kHz by the variable counter, this tuning voltage locks the vcmo to the correct 25-kHz increment.

A frequency detector is used in the 25-kHz loop, in addition to the phase detector, to provide the tuning voltage. Its output prevents the vcmo from being locked to a spurious mode when the frequency error is large. When the variable counter output is not 25 kHz, the frequency detector supplies outputs through the pulse stretcher stages to the fault monitor detector which produces an output to set the flip-flop phase detector. The outputs from the pulse stretchers also enable the high- or the low-frequency switch. If the frequency (from variable counter) is high, the high-frequency switch is enabled. The 25-kHz reference signal is supplied through this switch and the loop control ANDing network to limiter-amplifiers Z9Q14 through Z9Q15. A tuning voltage is produced to decrease the vcmo operating frequency. When the vcmo frequency is decreased so that the variable counter output is 25 kHz, the frequency detector provides outputs to disable both low- and high-frequency switches. The fault monitor detector now provides an output to enable the flip-flop phase detector (remove set control). The phase detector now supplies an output through the loop control ANDing network to provide the tuning voltage. Its output will lock (hold) the vcmo to the correct operating frequency.

The low-frequency switch is enabled when the variable counter output is lower than 25 kHz. The 25-kHz reference signal is now supplied through the low-frequency switch, and the loop control ANDing network to limiter amplifiers Z9Q14 through Z9Q15. This switch inverts the 25-kHz signal to change its duty factor, providing a tuning voltage which causes an increase in the vcmo operating frequency.

When the variable counter output is not 25 kHz, the fault monitor detector supplies an output to enable loop response control Z9Q13. This stage changes the response of the loop to slow down loop operation when the tuning voltage is causing a change in the vcmo operating frequency.

Lock indicator Z9Q6 supplies an output to power amplifier control Z41Q3, providing a signal to turn on or disable power amplifier Z2Q1. When either phase-locked loop is not operating at the proper frequency, the respective fault monitor detector supplies a warning output to lock indicator Z9Q6. The loss-of-signal detector supplies a warning to Z9Q6 when either the 25-kHz reference signal or the 25-kHz loop signal is lost. When Z9Q6 receives a warning from one of these three sources, it provides an output which causes power amplifier Z2Q1 to be disabled.

Information from frequency control wires is applied to the phase detector sensitivity control. This sensitivity control provides a means to vary the supply voltage for the limiter-amplifier stages in both 25- and 1-MHz loops. Thus, the phase detector sensitivity can be varied in four bands for the low range, providing maximum sensitivity at the high-frequency end, where the sensitivity of the voltage variable capacitors is lowest.

(3) 1051B-1 VHF NAV Receiver Planar Assembly, Block Diagram Theory.

(a) VHF Tuner and IF. Circuits. (Refer to figure 14.)

The vhf antenna input is applied to a 3-pole, minimum loss, rf tuned filter which is tuned by a dc tuning voltage applied from the vhf synthesizer to voltage variable capacitors in the filter. The output of the rf filter is applied to field-effect transistor (fet) first mixer Z8Q1 and Z8Q2, where it is mixed with the 126.00- to 135.95-MHz injection output of the vhf synthesizer. The difference signal is applied to 18-MHz crystal filter FL1. The 18-MHz output of FL1 is coupled through LC matching network L1, C1 to agc-controlled amplifiers Z7Q1 and Z7Q2 to produce an 18-MHz if. output.

The 18-MHz if. is applied to second mixer Z7Q4 where it is mixed with the 18.4985-MHz injection from local oscillator Z7Q3. At the mixer output is fixed tuned bandpass filter FL2 tuned to 498.5 kHz. Following the filter is 3-stage, RC-coupled, 498.5-kHz if. amplifier Z3Q1, Z3Q2, and Z3Q3. This 3-stage if. amplifier increases the signal to the desired level. The 498.5-kHz if. amplifier output is transformer coupled to detector Z3CR1. The detected audio from Z3CR1 is applied to isolation amplifiers Z3Q4 and Z3Q5. Isolation amplifiers Z3Q4 and Z3Q5 provide audio for the audio amplifier, audio for the VOR and the localizer instrumentation units, and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z3R31 and Z3R32. When the detected rf from detector Z3CR1 decreases, the agc differential amplifier (Z3Q6, Z3Q7, Z3Q10, Z3Q11) provides a decreasing output through agc output amplifier Z3Q8 to increase the gain of the if. amplifiers. When the detected rf from detector Z3CR1 increases, the agc differential amplifier provides an increasing output through agc output amplifier Z3Q8 to decrease the gain of the if. amplifiers.

A NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The NAV disable input is inverted by Z1Q2 and applied to if. disable Z1Q4 and tuning voltage disable Z1Q3. If. disable Z1Q4 saturates and grounds the reference level causing maximum agc, thereby disabling the if. stages. Tuning voltage disable Z1Q3 also saturates, and the dc tuning voltage applied from the vhf synthesizer is applied to ground.

(b) Audio Amplifier A5. (Refer to figure 14.)

The amplified output from the vhf NAV receiver detector is applied to input emitter follower Q1 in the audio amplifier for power gain and minimum loading of the vhf NAV receiver detector. From this input amplifier, the audio signal is applied to the response shaping network and audio amplifiers.

Audio bandpass filter FL1 shapes the response by attenuating 90- and 150-Hz localizer signals and the 9960-Hz subcarrier on VOR. The output from the bandpass filter, containing frequencies exclusive of VOR/LOC frequencies, is applied to audio amplifiers Q2 and Q3 and a phase splitter network containing Q4. PA drivers Q5 and Q6 apply the output to a push-pull output

stage consisting of Q7 and Q8. The output amplifiers bring the 51RV-2B VOR/ILS receiver aural output up to the required power level for the aircraft intercom system.

(c) VOR/ILS Audio Test Generator and Timer Z2. (Refer to figure 14.)

A self-test generator provides simulated VOR, localizer, and glideslope audio signals to modulate the VOR/LOC rf self-test oscillator in the vhf NAV receiver planar assembly and the glideslope rf self-test oscillator in the glideslope receiver planar assembly. Sine wave, phase-locked, 30 Hz, and 9960 Hz frequency modulated at 30-Hz signals are required in the VOR test mode. A 900-Hz audio signal is also provided for checking the audio amplifier stage in the vhf NAV receiver. Square-wave, phase-locked 90- and 150-Hz signals are required in the ILS test mode.

Assume that the 51RV-2B is in ILS mode (LOC frequency selected). This condition permits operation of ILS self-tests. The DN/R and UP/L push-button test switches on the 51RV-2B front panel or the remote DN/R and UP/L test switches on the cockpit control unit initiate the respective ILS tests when actuated. Upon initiating an ILS test, the VOR/LOC and glideslope flags drop into view for approximately 3 seconds and then are retracted for 20 seconds. The glideslope pointer shows a predetermined up (up/left test) or down (down/right test) indication and the VOR/LOC deviation bar shows a predetermined left (up/left test) or right (down/right test) indication (75 ua or 2-1/2 dots). If, after 20 seconds, the test initiate signal remains (test switch still engaged), the VOR/LOC and glideslope flags return to view, thereby preventing the pilot from flying on test commands should failure occur. Also, all of the 51RV-2B monitoring circuits are functioning normally during self-test. Any malfunction or failure that occurs during the 20 second self-test period will cause the respective VOR/LOC or glideslope flag(s) to come into view.

With the 51RV-2B tuned to an ILS frequency, the VOR/LOC mode relay is energized. ILS power is switched to all ILS circuits and +18 volts dc is switched to ILS circuits in the test generator and timer. This dc ILS input is applied to test request initiate Q15, down/right test Q16, up/left test Q17, and to the timer enable ORing circuit. As long as no ILS test switch is actuated, the output of the timer enable ORing circuit inhibits operation of 3-second timer Q11 and transistors Q15-Q17 remain saturated. Upon actuating either a DN/R or UP/L test initiate switch, a ground is applied to the cathode of CR16 or CR17 respectively. The dc ILS input is removed, thereby inhibiting test request initiate Q15 and Q16 (DN/R test switch engaged) or Q17 (UP/L test switch engaged). Down/right test Q16 and up/left test Q17 apply outputs to the glideslope/localizer combiner. These two inputs to the glideslope/localizer combiner place the combiner in a down/right test configuration or up/left test configuration respectively. The output of the timer enable ORing circuit is also removed when one of the ILS test initiate switches is engaged. Three-second timer operation begins.

Assuming the 51RV-2B to be in VOR mode (VOR frequency selected), a VOR test is initiated by actuating the VOR test switch on the 51RV-2B front panel or the VOR test initiate switch on the remote control unit. Upon initiating a

VOR test, the VOR/LOC flag drops into view for at least 3 seconds and up to 9 seconds (depending on the slew time of the RMI) and then is retracted for from 14 to 20 seconds (depending on the slew time of the RMI). The RMI pointer rotates to 180 degrees, and the VOR/LOC deviation indicator is centered. The VOR/LOC flag will return to view, if, after 14 to 20 seconds, the test initiate signal remains.

With the 51RV-2B tuned to a VOR frequency, the VOR/LOC mode relay is unenergized. VOR power is switched to all VOR circuits and +18 volts dc is switched to VOR circuits in the test generator and timer. This dc VOR input is applied to test request initiate Q15 and to the timer enable ORing circuit. As long as no VOR test switch is actuated, the output of the timer enable ORing circuit inhibits operation of 3-second timer Q11 and test request initiate Q15 remains saturated. When a VOR test switch is actuated, VOR timer enable CR18 is forward biased and the +18 volts dc VOR is removed to ground. The output of the timer enable ORing circuit is removed, causing the 3-second timer to begin operating. Test request initiate Q15 is inhibited, allowing 20-second timer Q14 to control flag enable Q13.

Assume that a test switch is actuated. With test request initiate Q15 inhibited, the base and collector voltage of flag enable transistor Q13 are equal, and Q13 is inhibited. The flag enable output from flag enable Q13 to the glideslope flag logic and driver and the VOR/LOC flag logic and driver is removed, causing the respective flags to show. Loss of output from the timer enable ORing circuit causes capacitor discharge in the 3-second timer network. After 3 seconds of discharge, the bias voltage on transistor Q11 enables 3-second timer Q11. The voltage developed across the output load of Q11 enables test enable control Q10 which enables test enable Q9. The test enable +18-volt dc output is applied to 20-second timer Q14 and to the 900-Hz multivibrator. The test enable signal disables 20-second timer Q14 for a 20-second interval. When Q14 is disabled, the base voltage on flag enable Q13 drops, thereby enabling Q13 and replacing the flag enable signal. This flag enable signal is applied to the 3-second timer network, holding the timer off when a test is not initiated and working in conjunction with 3-second timer hold switch Q15 to hold the 3-second timer on during test. If after 20 seconds the test initiate signal remains, Q14 again saturates and flag enable Q13 is again inhibited, removing the flag enable signal and returning the flags to view.

The test enable +18 volts dc applied to the 900-Hz multivibrator starts oscillation of the astable multivibrator which supplies a 900-Hz output to three counter networks. Counter A1 divides the 900-Hz input by six to produce a 150-Hz square wave. Counter A2 works with counter A7 to produce a 90-Hz square wave, and also works with counter A3 to produce a 30-Hz square wave. The square-wave output of counter A3 is differentiated and applied to sync trigger A11. The output of sync trigger A11 synchronizes the 150-Hz square-wave output and 90-Hz square-wave output to the 30-Hz square-wave output.

The 150-, 90-, and 30-Hz signals are applied to inverter network A12. This inverter network prevents loading of the counters.

The three output signals are amplified in amplifiers Q3, Q4, and Q5. The 90- and 150-Hz square waves are combined in the glideslope/localizer combiner to form the up/left or down/right ILS test signals. The self-test glideslope audio is applied to the glideslope receiver self-test oscillator/modulator directly from the combiner. The self-test localizer audio is applied through CR25 (CR26 is reverse biased by +18 volts dc ILS) to the VOR/LOC receiver self-test oscillator/modulator.

The 30-Hz VOR signal is synthesized in the RC combiner from the 30-, 90-, and 150-Hz square waves used in the ILS mode. The 30 Hz is applied to modulator Q6, which drives 9960-Hz multivibrator Q7 and Q8. The VOR signal output from the 9960-Hz multivibrator is a frequency-modulated signal with a 30-Hz amplitude modulation component. This signal obtains a 900-Hz audio component from 900-Hz amplifier Q18 and is then applied through CR26 (CR25 is reverse biased by +18 volts dc VOR) to the self-test oscillator/modulator in the vhf NAV receiver.

(d) RMI Servo Amplifier Z4. (Refer to figure 14.)

The RMI servo amplifier steps up magnetic heading information from the magnetic compass system to a level sufficient to drive the RMI compass card. Input C' is applied to the secondary of rate feedback transformer T1 and coupled through to the base of driver Q1. Input H' is applied to the base of driver Q2. Drivers Q1 and Q2 are connected in a push-pull configuration and apply outputs to the primary of 400-Hz tuned transformer T2. The 400-Hz output is further amplified by RMI amplifiers Q3 and Q4 before being applied to the output bridge circuit. The bridge circuit provides the output to drive the RMI compass card and also applies feedback to rate feedback transformer T1. The feedback is used to damp compass card rotation and prevent overshoot.

(e) 51RV-2B Power Supply Z6. (Refer to figure 14.)

1. +18-Volt DC Output.

The 51RV-2B +18-volt dc output requirement is obtained with a +20.2-volt switching preregulator followed by a +18-volt series regulator.

Capacitors C7, C8, C9, and C11 and resistor R31 form the input filter network that suppresses incoming high-frequency transients and prevents switching transients from being conducted back to the input.

The +20.2-volt switching preregulator consists of Q3, Q8, Q7, Q5, Q6, and Q4. When power is applied, switch Q3 will pass enough current to be sensed by current sensor Q8. This will enable reference amplifier Q7, changing the state of the timing multivibrator (Q5-Q6), and causing Q6 to saturate. Saturation of Q6 will enable switch driver Q4, driving it into saturation, thus causing switch Q3 to saturate. When the current passed by Q3 reaches 3 amperes, current sensor Q8 supplies current to Q7, disabling Q7, which turns off Q6, Q4, and Q3. Switch Q3 remains off for a few microseconds, determined by the current to Q7 and the timing multivibrator (Q5-Q6), and then turns on again, repeating the cycle until the

output of the switching preregulator is +20.2 volts. The on and off time of switch Q3 is regulated to maintain the output at +20.2 volts for inputs varying +21 to +30 volts. The current sensor network limits the current output of the switching preregulator to a maximum of 3 amperes. This protects both regulators from short circuits and overloads.

The output of Q10, an emitter follower, is monitored by reference amplifier Q12 which supplies the base current for amplifier Q11; Q11 in turn supplies the base current for driver Q9. The rate of conduction of Q9 regulates the base voltage of Q10 and, thus, its emitter output which is regulated at +18.0 volts.

2. +5-Volt DC Output.

The +5-volt output is provided by a dc-to-ac inverter and rectified by a full-wave rectifier, producing a ripple-free output.

Regulated +18 volts dc is applied through an isolation filter consisting of L1 and C1 to the primary of transformer T1. Transistors Q1 and Q2 and transformer T1 change the +18 volts dc into a 20-kHz square wave. This ac voltage is stepped down by the secondary of T1 and rectified into dc by full-wave rectifiers CR2 and CR3. The +5-volt dc output is filtered by L2 and C5.

(f) VOR/LOC Mode Relay Z1. (Refer to figure 14.)

The VOR/LOC mode relay switches VOR power to the VOR circuit when the 51RV-2B is in VOR mode (VOR frequency selected) and ILS power to the ILS circuit when the 51RV-2B is in ILS mode (localizer frequency selected).

The VOR mode enable ANDing circuit consisting of CR2 and CR3 has VOR/ILS mode input and a NAV disable input. When both inputs are at logic 1 (VOR frequency selected), switch Q1 is inhibited and relay K1 is unenergized; VOR power is switched to the VOR circuit in the 51RV-2B. When either the VOR/ILS logic or NAV disable input is at logic 0 (localizer frequency selected or a frequency out of NAV range selected), switch Q1 is saturated and relay K1 is energized; ILS power is switched to the ILS circuit in the 51RV-2B.

(4) 844A-1 VOR/LOC Instrumentation Planar Assembly, Block Diagram Theory.

(a) Primary VOR Instrumentation. (Refer to figure 15.)

The primary VOR instrumentation channel consists of circuits necessary to accomplish VOR operation. A monitor VOR channel which is identical to the primary channel is in parallel with the primary channel. The monitor channel receives the same audio input as the primary channel.

Automatic VOR operation provides the pilot with continuous VOR bearing, relative to magnetic heading, without mechanical manipulation by the pilot.

The reference 30-Hz signal which is FM modulated on the 9960-Hz subcarrier is coupled from the vhf receiver detector output to primary reference 9960-Hz amplifiers Z3Q1, Z3Q2, and Z3Q3. The 9960-Hz output signal from Z3Q3 is applied to primary reference slope detector Z3Q4 through Z3Q6. The slope detector converts the frequency changes of the FM input to amplitude changes, thereby providing a 30-Hz output. The reference signal is amplified in primary reference 30-Hz amplifiers Z1Q1 and Z1Q2. The output of primary reference 30-Hz amplifier Z1Q2 is applied to primary reference buffer amplifier Z1Q161 and to primary reference constant current driver Z1Q162. The output of amplifier Z1Q162 provides current for primary resolver Z1B3. The bearing servo motor B1 positions resolver Z1B3, providing a shift in phase to the reference 30-Hz signal. The output from B3 is amplified to the desired level by primary reference 30-Hz amplifiers Z1Q164 through Z1Q166 before being applied to the primary reference propeller modulation filter, which attenuates harmonics of the 30-Hz reference. The output of the propeller modulation filter is further amplified in primary reference 30-Hz amplifiers Z1Q3 and Z1Q4 and buffer amplifier Z1Q5. The output of Z1Q5 is applied as an input to a primary reference phase-splitter network consisting of transistors Z1Q6 through Z1Q9. The phase-splitter output is two 30-Hz reference signals 180 degrees out of phase.

The 30-Hz variable signal detected in the receiver is also amplified, filtered, and again amplified before being applied as an input to the phase detector. In the phase detector, the variable 30-Hz is amplified by buffer amplifier Z2Q31 and applied to a differential amplifier circuit consisting of Z2Q32, Z2Q33, Z2Q40, and Z2Q41. This differential amplifier circuit provides two square-wave outputs which are applied to a phase detector driver consisting of Z2Q34 and Z2Q35. The phase detector driver applies inputs to a synchronous chopper consisting of four field-effect transistors Z2Q36 through Z2Q39 and a 60-Hz notch filter. The two reference 30-Hz signals from the phase-splitter are also applied to the synchronous chopper and 60-Hz notch filter. If the reference and variable 30-Hz signals are 90 degrees out of phase, the output of the 60-Hz notch filter is negligible. If they are not 90 degrees out of phase, the 60-Hz notch filter provides a dc level output.

This dc level output is applied to 400-Hz chopper Z2Q77 which is driven by the 26-volt ac, 400-Hz signal coupled through chopper transformer T71. The dc level from the notch filter is thereby converted to 400-Hz ac and is amplified in bearing servo amplifier/driver Z2Q71 through Z2Q76 to drive the bearing servo motor. The motor shaft is mechanically connected to the rotor of resolver Z1B3 and, as the motor turns, the rotor of resolver Z1B3 is turned. The motor will continue to turn until the resolver produces a phase shift sufficient to produce a quadrature relationship between the reference and variable 30-Hz signals. Upon achieving this quadrature relationship, the motor will stop. A rate feedback signal from the generator is applied back to servo amplifier Z2Q71. The feedback is used to damp motor rotation.

The bearing servo motor positions the rotor of a synchro differential with respect to the stators, thereby providing VOR bearing information. The magnetic compass drives the stators of the differential to correspond to the

magnetic heading. Voltages are induced in the rotor windings of the synchro differential which are dependent on the angular position of the rotor and on the voltages supplied by the magnetic compass. These rotor voltages drive a synchro receiver called the pointer synchro. The rotor shaft of the pointer synchro is mechanically connected to the RMI pointer. The pointer gives a continuous indication of the angle between the magnetic heading of the aircraft and the VOR bearing. The compass card on the RMI is driven by compass information to give continuous magnetic heading information to the pilot. An RMI servo amplifier (figure 13) is used to increase the compass signal to a level sufficient to drive the RMI compass card.

When the 51RV-2B is tuned to a localizer frequency, the +18-volt dc ILS input to the RMI 3 o'clock bias circuit will cause the RMI pointer to rotate to the 3 o'clock (right wing) position.

(b) Manual VOR Instrumentation, Z1. (Refer to figure 15.)

Manual VOR operation provides the pilot with an indication of deviation from a selected VOR radial. The reference radial of flight is manually selected when the pilot operates the omnibearing selector (OBS) on the course indicator.

The 51RV-2B bearing servo motor rotates 400-Hz resolver B2. A 26-volt ac, 400-Hz signal from the aircraft power system is applied across the rotor of the 400-Hz resolver, inducing a voltage in the stators. This voltage is applied to the stator of a resolver in the external course indicator. The angular position of the rotor of this resolver is selected by the pilot when entering a course on the course indicator. If the course selected in the course indicator corresponds to the VOR bearing set by the motor shaft, the voltage induced in one of the resolver rotors of the course indicator will be 0 volt, and the deviation bar will provide an on-course indication. If the course selected in the course indicator does not correspond with the VOR bearing set by the motor shaft, a voltage will be induced in the rotor of the course indicator, and the deviation bar will provide the appropriate fly left or right indication.

Course resolver rotor A provides an input to the to/from discriminator in the manual VOR instrumentation circuit. The output of this discriminator is applied to the TO-FROM indicator in the external course indicator. The to/from indication from the discriminator is determined by the course of the aircraft, either to or from the VOR station, and by the pilot-selected OBS bearing. The VOR to/from indicator shows whether the direction to the VOR station is within the semicircle centered about the radial selected on the course selector (OBS) or within the semicircle centered about the reciprocal of the selected radial. If the station direction is within 90 degrees of the selected radial, a TO indication appears on the course indicator. If the station direction is within 90 degrees of the reciprocal of the selected radial, a FROM indication appears.

Course resolver rotor B provides an input to the two identical VOR deviation discriminators (one for primary deviation, and the other for secondary deviation). The output of the primary VOR deviation discriminator is

applied to the VOR deviation loads in the aircraft, and to one of the inputs of the VOR/LOC comparator. The output of the secondary VOR deviation discriminator provides the second input to the VOR/LOC comparator. Any deviation difference between the primary and secondary deviation discriminator outputs that is greater than a predetermined (and adjustable) amount will be detected by the comparator, and cause a VOR warning flag to show.

When the 51RV-2B is in VOR mode, damping switch Z1Q241 saturates and provides additional damping for both the primary and secondary VOR deviation outputs. When the 51RV-2B is in ILS mode, damping switch Z1Q241 is inhibited, thus providing normal damping requirements for LOC.

Both VOR and LOC use the same VOR/LOC sensor for deviation comparison and signal level sensing. Assume that the 51RV-2B is in the ILS mode (LOC frequency selected). The LOC level voltage from the deviation discriminator circuits (primary and secondary) is applied to the level sensor and the threshold of the level sensor is set by adjustment of FLAG THRESHOLD control Z2R70. Assume that the 51RV-2B is in the VOR mode. The VOR level voltage from the deviation discriminator circuits (primary and secondary) is greater than the level voltage obtained from the LOC deviation circuits. Therefore, the VOR level voltage must be reduced to coincide with the threshold adjustment made with the 51RV-2B in ILS mode. The reduction of VOR level voltage is accomplished by the saturation of level switch Z1Q242 when the 51RV-2B is in the VOR mode. With Z1Q242 saturated, Z1R255 is inserted across the VOR level voltage and shunts the VOR level down to the level required for proper operation of the level sensor (as adjusted for LOC).

NOTE: For detailed block diagram theory of operation on the manual VOR/LOC sensor, refer to paragraph 5.D.(4)(d), localizer instrumentation and manual VOR/LOC sensor.

(c) Monitor VOR Instrumentation. (Refer to figure 15.)

The monitor VOR channel contains a circuit which is identical to the primary VOR channel. The monitor channel does not drive the bearing servo motor like the primary channel, but the monitor channel does maintain a quadrature phase relationship at its output when the two channels track . These outputs are applied to the VOR null sensor which provides a 2-kHz, square-wave output when the quadrature relationship is maintained within the comparator gate width and the level drops not more than 2 db from normal. A warning from the flag circuit results when any phase shift occurs greater than the gate width tolerance.

The reference 30-Hz signal which is frequency modulated (FM) on the 9960-Hz subcarrier is applied from the VOR receiver detector output to monitor reference 9960-Hz amplifiers Z3Q101 - Z3Q103. The 9960-Hz signal output from Z3Q103 is applied to monitor reference slope detectors Z3Q104 through Z3Q106. The slope detector converts the frequency changes of the FM input to amplitude changes, thereby providing a 30-Hz signal output. The reference signal is amplified in monitor reference 30-Hz amplifiers Z1Q81 and Z1Q82 and applied to a propeller modulation filter which attenuates

harmonics of the 30-Hz reference signal. The output is then amplified in monitor reference 30-Hz amplifiers Z1Q83 through Z1Q87 and applied as an input to the VOR null sensor.

The 30-Hz variable signal detected in the receiver is amplified by Z1Q121 and Z1Q122. The output of monitor variable 30-Hz amplifier Z1Q122 is applied to buffer amplifier Z1Q181 and monitor variable constant current driver Z1Q182. The output of amplifier Z1Q182 provides current for monitor resolver Z1B5. Bearing servo motor B1 positions resolver Z1B5, providing a shift in phase to the variable 30-Hz signal. The output from B5 is amplified to the desired level by monitor variable 30-Hz amplifiers Z1Q184 through Z1Q186 before being applied to a propeller modulation filter which attenuates harmonics of the 30-Hz variable signal. The output of the propeller modulation filter is further amplified in monitor variable 30-Hz amplifiers Z1Q123 through Z1Q125 and applied as an input to a monitor variable differential amplifier/phase-splitter network consisting of transistors Z1Q126 through Z1Q129. The phase-splitter output is two 30-Hz variable signals 180 degrees out of phase.

One of the 30-Hz variable signals is phase compared to the reference 30-Hz signal in a phase detector consisting of Z3CR131 and Z3CR132. The other 30-Hz variable signal is phase compared to the reference 30-Hz signal in the phase detector consisting of Z3CR133 and Z3CR134. The two dc level outputs are applied through buffer amplifier Z3Q131 to differential amplifier Z3A101.

The 30-Hz variable signal that is applied to phase detector Z3CR133 and Z3CR134 is also applied to rectifier Z3CR138 and Z3CR139. The resulting dc output is applied to the base of variable level sensor Z3Q136. A 2-kHz reference signal is also applied to the base of variable level sensor Z3Q136. If the dc level applied to the base of Z3Q136 is the correct level, Z3Q136 is enabled, and the 2-kHz reference signal is applied to the base of reference level sensor Z3Q135. The monitor 30-Hz reference signal from monitor reference 30-Hz amplifiers Z3Q83 through Z3Q87 is applied to rectifier Z3CR136 and Z3CR137 which converts the signal to a dc level and applies the dc level to the base of reference level sensor Z3Q135. If this dc level is within the gate width, Z3Q135 is enabled and the 2-kHz signal is applied to differential amplifier Z3A101. The 2-kHz signal will be amplified and appear at the respective output terminal when the amplifier input is balanced. The 2-kHz signal will not appear when the output amplifier is saturated or inhibited. The amplifier differential gain and the operating point of its output stage are adjusted so that at the desired input difference voltage the output stage ceases to amplify because of cutoff or saturation. At these limit points the ac output signal disappears.

If the VOR circuit is functioning normally, the 2-kHz signal is applied to buffer amplifiers Z3Q133 and ac amplifier Z3Q134. The output of buffer amplifier Z3Q134 is applied to a synchronous filter time delay consisting of resistors Z3R153 and Z3R154 and capacitor Z3C137, with Z3Q137 providing switching. The 2-kHz input to the time delay circuit is synchronously switched by Z3Q137, which has a similar 2-kHz input to its base. Capacitor Z3C137 charges through resistor Z3R153 as each pulse is applied and

discharges through resistor Z3R154 when the 2-kHz input to the time delay is removed.

Any failure producing an inbalance in differential amplifier Z3A101 inhibits the 2-kHz output signal, causing the VOR flag to show. The manual VOR/LOC sensor provides a 2-kHz, square-wave output when the primary VOR channel is operating properly. Both this 2-kHz signal and the 2-kHz signal from the monitor channel must be present at the VOR/LOC flag logic and driver to energize the VOR flag and remove it from view. If either channel fails, the failure will cause the VOR flag to show.

(d) Localizer Instrumentation Z1 and Manual VOR/LOC Sensor Z2. (Refer to figure 15.)

From the vhf tuner and if. circuits, audio output signals are applied to two localizer instrumentation channels, a primary and a secondary channel. In each channel the 90- and 150-Hz signals are amplified and separated by filters. The filter has two tuned secondaries, one resonant at 150 Hz and the other resonant at 90 Hz. Each audio signal is rectified.

Deviation output for the course indicator is taken from the primary channel. Deviation output for comparison with the primary channel deviation output, and for testing purposes, is taken from the secondary channel. If the 150-Hz voltage is greater than the 90-Hz voltage, current flows through the deviation indicator in a direction that causes the deviation bar to deflect to the right. If the 90-Hz voltage is greater than the 150-Hz voltage, current flows through the deviation indicator in a direction that causes the deviation bar to deflect to the left. If the 90- and 150-Hz signals are equal, the resulting zero voltage developed causes zero current to flow, centering the deviation bar.

Level outputs are taken from the primary VOR channel (VOR mode) or localizer channel (ILS mode) and applied to the VOR/LOC level sensor. Each of the two level outputs are filtered and applied to a level modulator/chopper consisting of field-effect transistors (fet) Q18 and Q19. Switching is accomplished in level modulator/chopper Q18 and Q19 by a 2-kHz input to the fet's. The 2-kHz ac signals are applied to the manual VOR/LOC sensor from the dc-to-ac inverter located on the glideslope receiver planar assembly. The 2-kHz outputs from the dc-to-ac inverter are also applied to a full-wave rectifier consisting of diodes CR12 through CR15, thereby producing the +30-volt dc and -30-volt dc power required in the manual VOR/LOC sensor. The resulting 2-kHz difference voltage from the modulator/chopper is amplified by operational amplifier A7 and demodulated to a dc voltage. The dc voltage is applied to differential-amplifier level sensor consisting of Q23 and Q25, whose reference is perturbed at a 50-kHz rate by the output of 50-kHz oscillator Q24. When the demodulated dc level is above the minimum reference level and below the maximum perturb level, a 50-kHz, square-wave output results. 90- and 150-Hz levels greater than 4 db above or 2 db below normal result in no 50-kHz output. The 50-kHz output signal is attenuated to a low level and applied to the VOR/LOC comparator channel.

The fail-safe comparator circuit receives the deviation outputs primary + right deviation and secondary + right deviation from the manual VOR instrumentation (VOR mode) or from the localizer instrumentation (ILS mode) and RC filters these inputs to remove any remaining ripple. The two dc deviation signals are then added to the 50-kHz signal from the level sensor, in a filter and summing network consisting of R1, R2, C3, and C4. The ac signals with dc deviation levels are applied to a difference modulator/chopper consisting of field-effect transistors Q1 and Q2, with switching accomplished by 2-kHz inputs to the fet's. After modulation in Q1 and Q2 and amplification by operational amplifiers A1-A3, a 2-kHz, square-wave difference signal is produced with amplitude proportional to sec + r dev minus pri + r dev and with a small 50-kHz modulation. This signal is applied to a clipper-limiter circuit consisting of diodes CR1 through CR4 whose threshold is above the 50-kHz signal level when pri + r dev equals sec + r dev. When the difference voltage pri + r dev minus sec + r dev increases above the clipper threshold, the 50-kHz modulation is stripped off and its level is reduced. The threshold modifier limiter changes the clipper threshold as a function of the modifier input.

The 51RV-2B comparator utilizes a separate VOR/LOC threshold modifier channel. The dc deviation levels are summed and superimposed on the output of modulator shunt chopper Q11. This produces a square-wave signal that is amplified in operational amplifiers A5-A6 and detected in Q16 converting the square-wave output to dc. The dc is applied to limiter control Q17, and the output voltage is proportional to the deviation deflection. Limiter control input to the threshold modifier limiter makes the comparison warning gate width increase proportionally with the absolute deviation magnitudes. The limiter output is applied through a spike limiter circuit before being amplified by operational amplifier A4 and transformer coupled to 50-kHz detector Z1CR281, Z1CR282. The detector output is applied to differential amplifier level sensor Z1Q281, Z1Q283 whose reference is perturbed at a 2-kHz rate and to amplifier Z1Q282. When the detected dc level is above the minimum reference level and below the maximum perturb level, a 2-kHz, square-wave output results. The level sensor in the manual VOR/LOC sensor is capable of discriminating the 6-db amplitude change that results at the detector when a chopper fails and remains in one state. Component failures in the comparator of the manual VOR/LOC sensor will usually cause loss of the 50-kHz signal entirely or change the 50-kHz amplitude enough to lose the output signal and present a warning condition. Any change from normal will cause the output 2-kHz signal to disappear and place the VOR/LOC CCCS flag, high power flag, and low-level flag outputs at zero. When this condition occurs, the VOR/LOC flag will come into view.

(e) VOR/LOC Flag Logic and Driver, and Power Flag. (Refer to figure 15.)

The VOR/LOC flag logic and driver requires two 2-kHz inputs to energize power flag relay Z1K281 when the 51RV-2B is in VOR mode. The VOR/LOC flag logic and driver requires one 2-kHz input to energize power flag relay Z1K281 when the 51RV-2B is in ILS mode.

When the 51RV-2B is in VOR mode, the 2-kHz output of Z1Q282 is applied to the AND gate circuit containing Z3Q181. The 2-kHz output from the VOR

null sensor in the monitor VOR channel must also be present before the AND gate will apply an output to exclusive OR gate Z3Q182. If the vhf synthesizer lock input to the exclusive OR gate is a logic 1 (vhf synthesizer on frequency), Z3Q182 will couple the signal to flag driver Z3Q183. If the flag enable signal is present (no self-test initiated), flag driver Z3Q183 will provide a 2-kHz output. The 2-kHz output from flag driver Z3Q183 is rectified and applied to power flag relay Z1K281. The relay is energized and CCCS flag, high power flag, and low-level flag outputs are provided to remove the VOR/LOC flags from view.

When the 51RV-2B is in ILS mode, the output from AND gate Z3Q181 is removed due to loss of 2 kHz from the VOR null sensor. However, the 2 kHz from amplifier Z3Q182 is now coupled through inverters Z3Q184 and Z3Q185. Bias voltage for the two inverters is provided by +18 volts dc ILS, not present when the 51RV-2B is in VOR mode. The 2-kHz output from Z3Q185 is applied to exclusive OR gate Z3Q182 and is processed to energize the power flag relay in the same manner as the input from Z3Q181, applied when the 51RV-2B is in VOR mode.

(5) 951A-1 Glideslope Receiver Planar Assembly, Block Diagram Theory.

(a) UHF Synthesizer (Refer to figure 16.)

The uhf synthesizer provides 119.8- to 121.7-MHz rf injection to the glideslope receiver. The injection frequency is tripled and applied to the first mixer, where it is used to provide the 30.1-MHz first if.

119.8- to 121.7-MHz output from voltage-controlled oscillator Z12Q3 is amplified and applied to mixer Z12Q6 along with the appropriate injection signal of the matching VOR/LOC frequency from the vhf synthesizer (126.1 to 129.9 MHz). The resulting if. signal of 4.5 to 9.5 MHz is filtered and amplified before being applied to a variable counter. Pilot-selected information from the tuning wires controls the division ratio of the variable counter between 90 and 190.

When the output of vco Z12Q3 is tuned to the appropriate frequency, the variable counter output is a 50-kHz signal. This signal is applied to a flip-flop phase detector and a frequency detector network. The reference 50-kHz signal is applied to the phase detector and frequency detector. With both the reference input and the variable counter output signal at 50 kHz, the frequency detector applies outputs to Z10Q7 and Z10Q8, which disable Z10Q7 and Z10Q8. With Z10Q7 and Z10Q8 disabled, the pulse stretcher networks and output transistors Q1 and Q2 are disabled. The logic 1 levels appearing on the collector of Z10Q1 and of Z10Q2 are applied to the flip-flop phase detector and to uhf synthesizer lock detector A3A. The logic 0 output from lock detector A3A disables loop response control Z10Q9 and uhf synthesizer lock indicator Z10Q3. The positive voltage output resulting from the disabling of lock indicator Z10Q3 permits transistor Z12Q5 to be enabled, providing that disable inverter Z12Q11 is disabled. When Z12Q5 is enabled, output amplifier Z12Q4 is also enabled. This then provides the 119.8- to 121.7-MHz output from the uhf synthesizer to the glideslope receiver. Transistor Z12Q5 will be enabled when the glideslope NAV disable and test

enable inputs to inverter Q11 are at logic 0. Energizing a test or choosing a frequency that is not a VOR/ILS frequency (on the control unit) will put the test enable or glideslope NAV disable input at logic 1. The uhf synthesizer output is then inhibited by the input to output amplifier control Z12Q5 from disable inverter Z12Q11. The logic 1 levels applied from the pulse stretcher networks to flip-flop phase detector A1 prevent the flip-flop from going into the set or reset condition. The 50-kHz reference input and the 50-kHz signal input to the flip-flop phase detector triggers the flip-flop and provides a 50-kHz output signal, which is coupled through limiter-amplifier Z10Q4 to 50-kHz, low-pass filter FL1. The filter removes the 50-kHz component and provides a dc level dependent on the duty cycle of the input 50-kHz signal. This dc level is applied to the tank circuit controlling the output of vco Z12Q3. Vco Z12Q3 is thereby locked to the correct frequency.

When the output of vco Z12Q3 is not tuned to the correct frequency, the variable counter output differs in frequency from the 50-kHz reference. The frequency detector output enables Z10Q8 or Z10Q7, depending upon whether the vco is low in frequency or high in frequency respectively. The pulse stretcher network maintains the output of Z10Q2 or Z10Q1 at a logic 0. This logic 0 from either Z10Q2 (vco low in frequency) or Z10Q1 (vco high in frequency) is applied to the R_d (or S_d) terminal of the flip-flop phase detector and to uhf synthesizer lock detector A3A. The lock detector applies a logic 1 to the base of loop response control Z10Q9 and uhf synthesizer lock indicator Z10Q3. The output from lock indicator Z10Q3 permits output amplifier control Q5 to be disabled, thereby inhibiting off-frequency rf injection through output amplifier Q4. The flip-flop phase detector is put in a reset (or set) state by the logic 0 input to the R_d (or S_d) terminal from the pulse stretcher. Limiter-amplifier Z10Q4 is enabled (or disabled) by the phase detector output and thereby provides for a higher (or lower) tuning voltage output to the 50-kHz, low-pass filter. The loop response control network, switched into the tuning voltage output circuit by loop response control Z10Q9, slows the application of this tuning voltage to the 50-kHz filter and subsequent vco Z12Q3 tank circuit. When vco Z12Q3 has tracked to the proper frequency, the reset (or set) condition is removed from the flip-flop phase detector, and the tuning voltage is held constant. The output from lock indicator Z10Q3 returns to normal, and output amplifier Z12Q4 is again enabled. The rf output from the uhf synthesizer (119.8 to 121.7 MHz) is applied to the tripler in the glideslope receiver.

(b) UHF Tuner and IF. Circuits.

1. Glideslope Receivers Up to MCN 218. (Refer to figure 16.)

The glideslope antenna input is applied to a minimum loss bandpass filter passing the frequency band 329.3 through 335.0 MHz. The output of the filter is applied to field-effect transistor first mixer Z7Q1, where it is mixed with the tripled injection frequency (359.4 to 365.1 MHz) of the uhf synthesizer. The uhf synthesizer signal is applied through tripler Z7Q3 into mixer Z7Q1.

The difference signal from the mixer is applied to 30.1-MHz crystal filter FL7. The 30.1-MHz output of FL7 is coupled through RC matching

network Z6R1, C1 to agc-controlled amplifiers Z6Q1 and Z6Q2 to produce a 30.1-MHz if. output. The signal is then mixed a second time in second mixer Z6Q3 with an input of 29.6 MHz from oscillator Z6Q4. The difference output from this mixer is filtered in 500-kHz filter FL1. Following the filter is 3-stage, RC-coupled, 500-kHz if. amplifiers Z5Q1, Z5Q2, and Z5Q3 with agc control feedback to the first two stages. This 3-stage if. amplifier brings the signal to the desired level. The amplifier output is transformer coupled to detector Z5CR1.

The detected rf from Z5CR1 is applied to isolation amplifiers Z5Q4 and Z5Q5. Isolation amplifiers Z5Q4 and Z5Q5 provide the audio signal necessary to operate the glideslope instrumentation, and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z5R31 and Z5R32. When the detected level from detector CR1 decreases, the agc differential amplifier (Z5Q6, Z5Q7, Z5Q10, Z5Q11) provides an output through agc output amplifier Z5Q8 to increase the gain of the if. amplifiers. When the detected level from detector Z5CR1 increases, the agc differential amplifier provides an output through agc output amplifier Z5Q8 to decrease the gain of the if. amplifiers.

A glideslope NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The glideslope NAV disable input is applied to the base of if. disable Z1Q1 to saturate and ground the agc reference level. As a result, the agc output is raised to maximum level and the if. stages are disabled.

2. Glideslope Receivers With MCN 219 and Above. (Refer to figure 17.)

The glideslope antenna input is applied to a minimum loss bandpass filter passing the frequency band 329.3 through 335.0 MHz. The output of the filter is applied to field-effect transistor first mixer Z7Q1, where it is mixed with the tripled injection frequency (359.4 to 365.1 MHz) of the uhf synthesizer. The uhf synthesizer signal is applied through tripler Z7Q3 into mixer Z7Q1.

The difference signal from the mixer is applied to 30.1-MHz crystal filter Z7FL7. The 30.1-MHz output of Z7FL7 is coupled through RC matching network Z7R24, C26 to agc-controlled amplifiers Z7Q6 and Z7Q7 to produce a 30.1-MHz if. output. The signal is mixed a second time in second mixer Z7Q8 with an input of 29.6 MHz from oscillator Z7Q9. The difference output from this mixer is filtered in 500-kHz filter Z7FL8. Following the filter is 3-stage, RC-coupled, 500-kHz if. amplifiers Z5Q1, Z5Q2, and Z5Q3 with agc control feedback to the first two stages. This 3-stage if. amplifier brings the signal to the desired level. The amplifier output is transformer coupled to detector Z5CR1.

The detected rf from Z5CR1 is applied to isolation amplifiers Z5Q4 and Z5Q5. Isolation amplifiers Z5Q4 and Z5Q5 provide the audio signal necessary to operate the glideslope instrumentation, and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z5R31 and Z5R32. When the detected level from detector CR1 decreases, the agc differential amplifier (Z5Q6, Z5Q7, Z5Q10, and Z5Q11) provides an output through agc output amplifier Z5Q8 to increase the gain of the if. amplifiers. When the detected level from detector Z5CR1 increases, the agc differential amplifier provides an output through agc output amplifier Z5Q8 to decrease the gain of the if. amplifiers.

A glideslope NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The glideslope NAV disable input is applied to the base of if. disable Z1Q1 to saturate and ground the agc reference level. As a result, the agc output is raised to maximum level and the if. stages are disabled.

(c) Glideslope Instrumentation Z4 and ILS Sensor Z13. (Refer to figure 16 or 17.)

From the detector circuit, output signals are applied to two instrumentation channels, a primary and a secondary channel. In each channel the 90- and 150-Hz audio signals are amplified and separated by filters. The filter has two tuned secondaries, one resonant at 150 Hz and the other resonant at 90 Hz. Each audio signal is rectified.

The deviation output indication for course indicators is taken from the primary channel. Deviation output for comparison with the primary channel deviation output and for testing purposes is taken from the secondary channel. If the 150-Hz voltage is greater than the 90-Hz voltage, current flows through the deviation meter movement in a direction that causes the deviation indicator to deflect up. If the 90-Hz voltage is greater than the 150-Hz signal, current flows through the deviation meter movement in a direction that causes the deviation indicator to deflect down. If the 90- and 150-Hz signals are equal, the resulting zero voltage developed causes zero current to flow, centering the deviation indicator.

Level outputs are taken from the primary channel and applied to the level sensor in the ILS sensor. Each level output is filtered and applied to a level modulator/chopper which consists of field-effect transistors (fet) Z13Q18 and Z13Q19. A 2-kHz input is applied to each fet from dc-to-ac inverters Z4Q1 and Z4Q2. The pair of 2-kHz signals from the dc-to-ac inverter are also applied to the full-wave rectifier consisting of diodes Z13CR12 through Z13CR15. This full-wave rectifier provides +30- and -30-volt dc power to the ILS sensor circuit. The input to Z13Q18 is 180 degrees out of phase with respect to the input to Z13Q19. The resultant output of the fet's is a 2-kHz square wave with amplitude proportional to the difference between the two level inputs. Operational amplifier Z13A7 amplifies the signal and applies an input to demodulator Z13Q22. The output of Z13Q22 is a dc difference voltage. This dc voltage is applied to a differential amplifier level sensor consisting of Z13Q25 and Z13Q23, whose reference is perturbed at a 50-kHz rate by an input applied from 50-kHz oscillator Z13Q24. When the demodulated dc level is above the minimum reference level and below the maximum perturb level, a 50-kHz, square-wave output results. 90- and 150-Hz levels greater than 4 db above or 2 db below

normal result in no 50-kHz output. The 50-kHz output signal is attenuated to a low level and applied to the comparator channel.

The fail-safe comparator circuit receives the deviation outputs primary + down deviation and secondary + down deviation from the glideslope instrumentation. These inputs are filtered to remove any remaining ripple. The two dc deviation signals are then added to the 50-kHz signal, from the level sensor, in a filter and summing network consisting of R1, R2, C3, and C4. The ac signals with dc deviation levels are then applied to a difference modulator/chopper consisting of field-effect transistors Z13Q1 and Z13Q2, with switching accomplished by a 2-kHz input to the fet's. After modulation in Z13Q1 and Z13Q2 and amplification by operational amplifiers Z13A1 through Z13A3, a 2-kHz, square-wave difference signal is produced with amplitude proportional to sec + down dev minus pri + down dev and with a small 50-kHz modulation. This signal is applied to a threshold modifier and clipper-limiter circuit consisting of diodes Z13CR1 through Z13CR4, whose threshold is above the 50-kHz signal level when pri + down dev equals sec + down dev. When the difference voltage sec + down dev minus pri + down dev increases above the clipper threshold, the 50-kHz modulation is stripped off, and its level is reduced. The clipper threshold modifier changes the clipper threshold as a function of the modifier input. The 51RV-2B comparator utilizes a separate threshold modifier channel. The dc deviation levels are summed and superimposed on the output of modulator shunt chopper Z13Q11. This produces a square-wave signal that is amplified in operational amplifiers Z13A5 and Z13A6, and detected in Z13Q16, converting the square-wave output to dc. The dc is applied to limiter control Z13Q17. The output voltage from limiter control Z13Q17 is proportional to the deviation deflection. This threshold modifier input to the clipper-limiter makes the comparison warning gate width increase proportionally with the absolute deviation magnitudes. The output of the clipper-limiter circuit is amplified in operational amplifier Z13A4 and transformer coupled to 50-kHz detector Z13CR81, Z13CR82. The detector output is applied to differential amplifier level sensor Z13Q81, Z13Q83 whose reference is perturbed at a 2-kHz rate, and to amplifier Z13Q82. When the detected dc level is above the minimum reference level and below the maximum perturb level, a 2-kHz, square-wave output results.

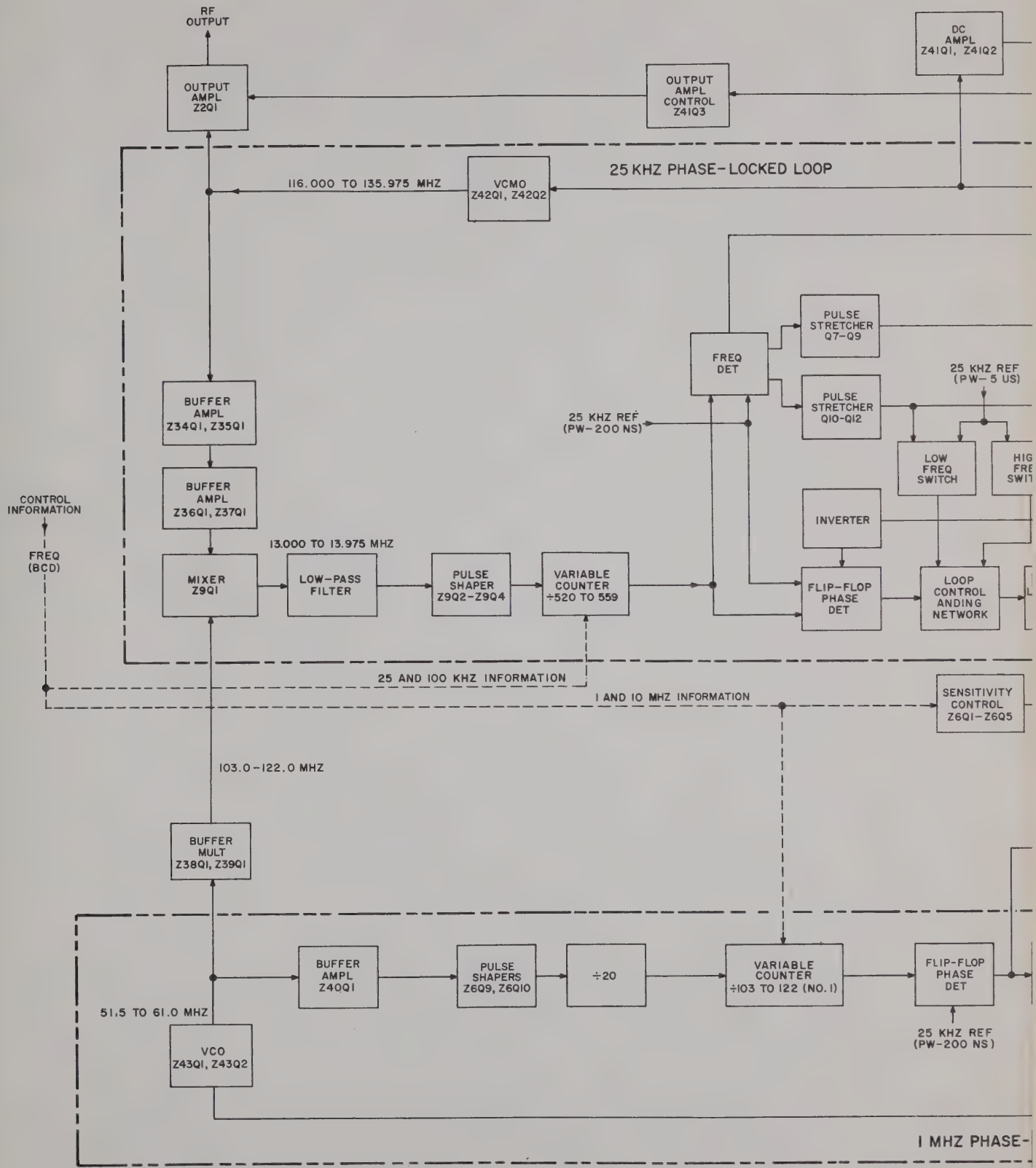
The level sensor in the ILS sensor is capable of discriminating the 6-db amplitude change that results at the detector when a chopper fails to remain in one state. Component failures in the comparator of the ILS sensor will usually cause loss of the 50-kHz signal entirely or change the 50-kHz amplitude enough to lose the output signal and present a warning condition. Any change from normal will cause the 2-kHz ILS sensor output signal to disappear and place the glideslope CCCS flag, high power flag, and low-level flag outputs at zero. When this condition occurs, the glideslope flags will come into view.

(d) Glideslope Flag Logic and Driver Z2. (Refer to figure 16 or 17.)

The 2-kHz signal from amplifier Z13Q82 is applied to amplifier Z2Q2. Amplifier Z2Q2 amplifies the 2-kHz signal and applies it to the base of flag driver Z2Q3. The 2-kHz output from Z2Q3 is applied to detectors Z2CR1

and Z2CR3. Detectors Z2CR1 and Z2CR3 convert the 2-kHz signal to a dc level sufficient to operate power flag relay Z2K1. The high power glideslope flag, CCCS flag, and low-level flag outputs are controlled by power flag relay Z2K1.

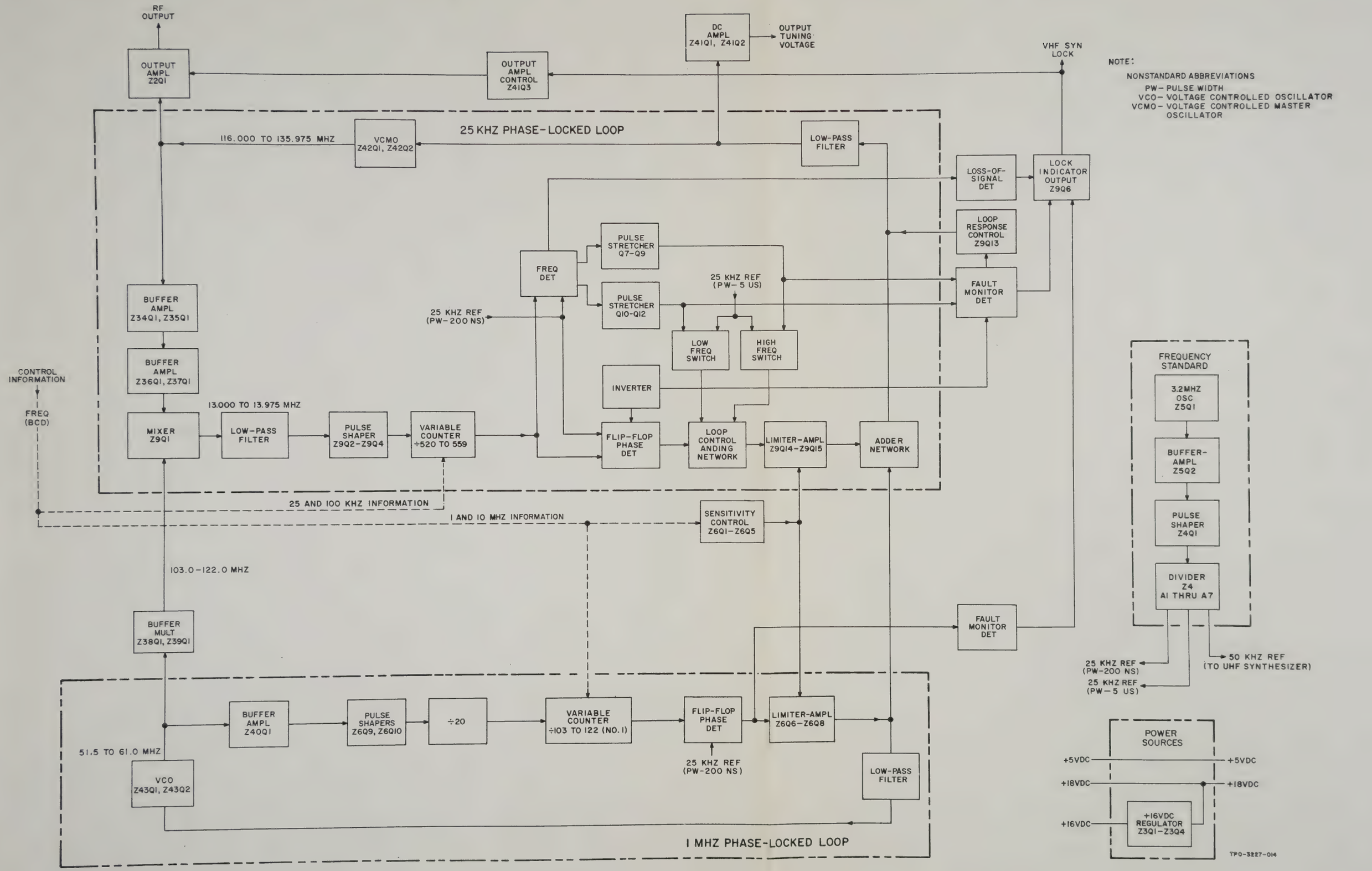
When the 51RV-2B is in the ILS mode, switch Z2Q1 is inhibited and any glideslope warning flag that occurs is due to a malfunction in the glideslope circuits. However, when the 51RV-2B is in the VOR mode, the glideslope flag remains out of view. This glideslope flag bias during VOR operation is provided by +18-volts dc being applied to the collector of switch Z2Q1, causing Z2Q1 to saturate. The 2-kHz signal present on the base of Z2Q1 is applied through Z2Q1 to Z2Q2. The 2-kHz signal is processed as discussed in the preceding paragraph, causing power flag relay Z2K1 to acutate. This removes the glideslope flag from view when the 51RV-2B is in the VOR mode.



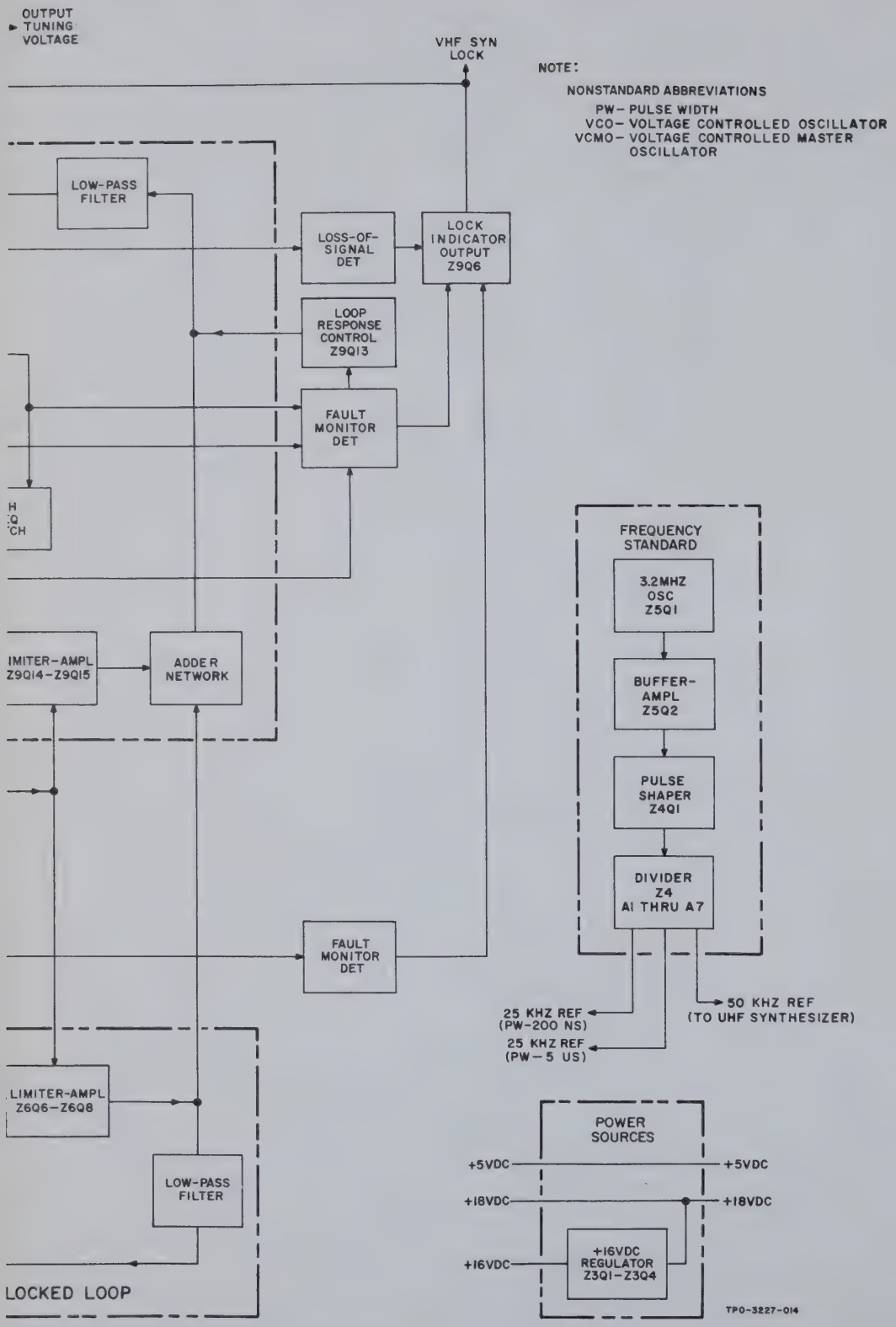
VHF Synthesizer Planar Assembly, Detailed Block Diagram
Figure 13

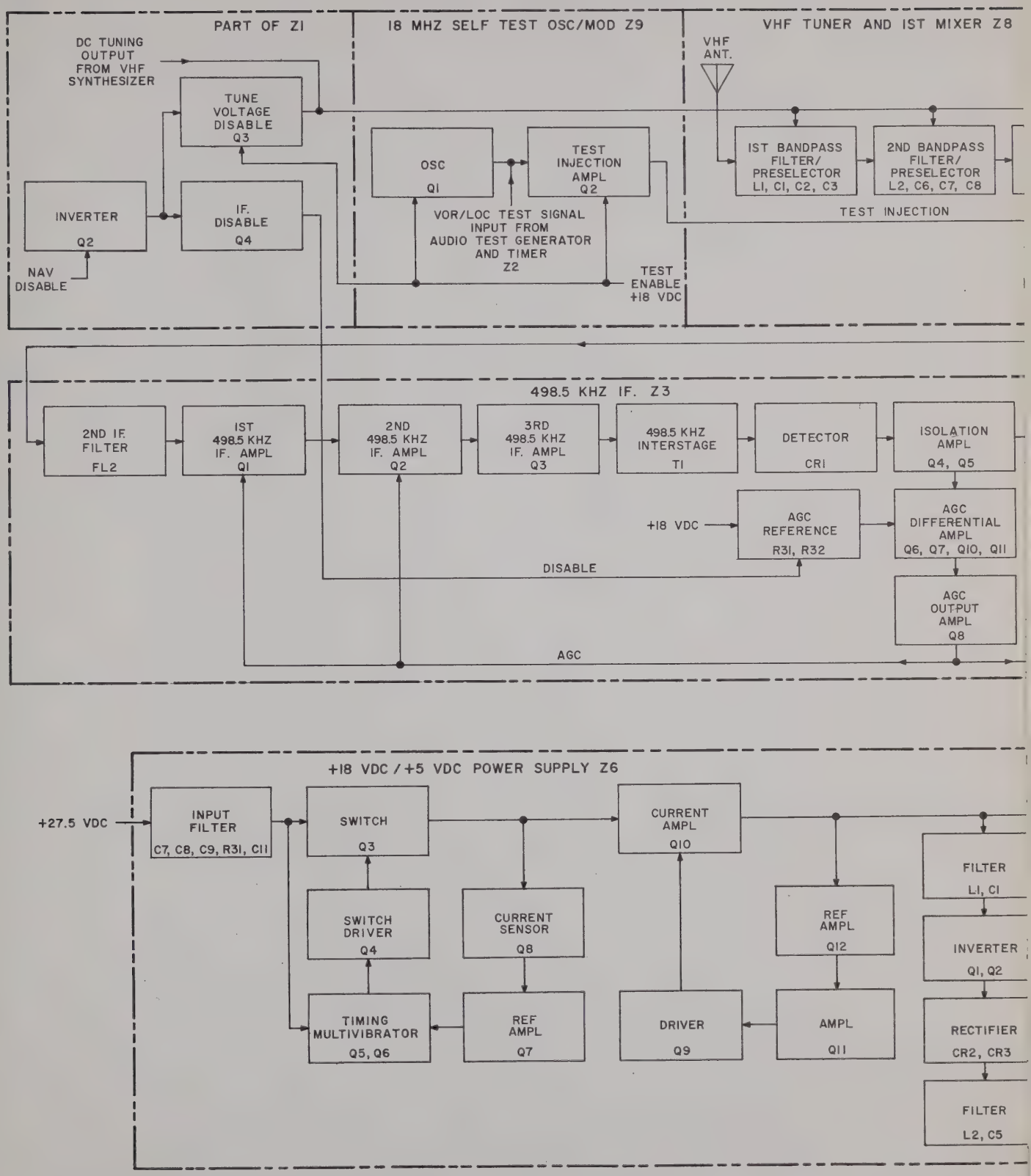
and Z2CR3. Detectors Z2CR1 and Z2CR3 convert the 2-kHz signal to a dc level sufficient to operate power flag relay Z2K1. The high power glideslope flag, CCCS flag, and low-level flag outputs are controlled by power flag relay Z2K1.

When the 51RV-2B is in the ILS mode, switch Z2Q1 is inhibited and any glideslope warning flag that occurs is due to a malfunction in the glideslope circuits. However, when the 51RV-2B is in the VOR mode, the glideslope flag remains out of view. This glideslope flag bias during VOR operation is provided by +18-volts dc being applied to the collector of switch Z2Q1, causing Z2Q1 to saturate. The 2-kHz signal present on the base of Z2Q1 is applied through Z2Q1 to Z2Q2. The 2-kHz signal is processed as discussed in the preceding paragraph, causing power flag relay Z2K1 to acutate. This removes the glideslope flag from view when the 51RV-2B is in the VOR mode.

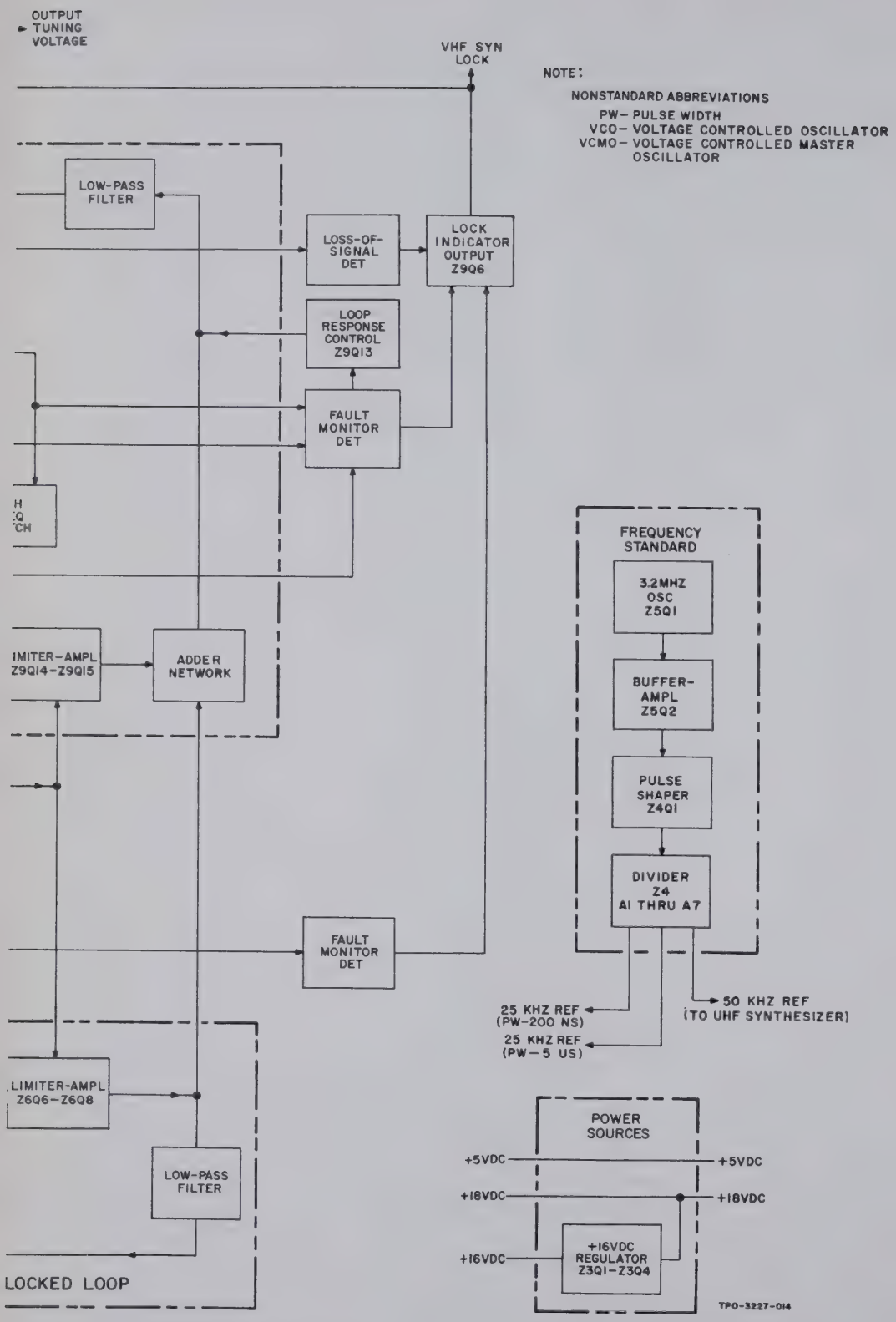


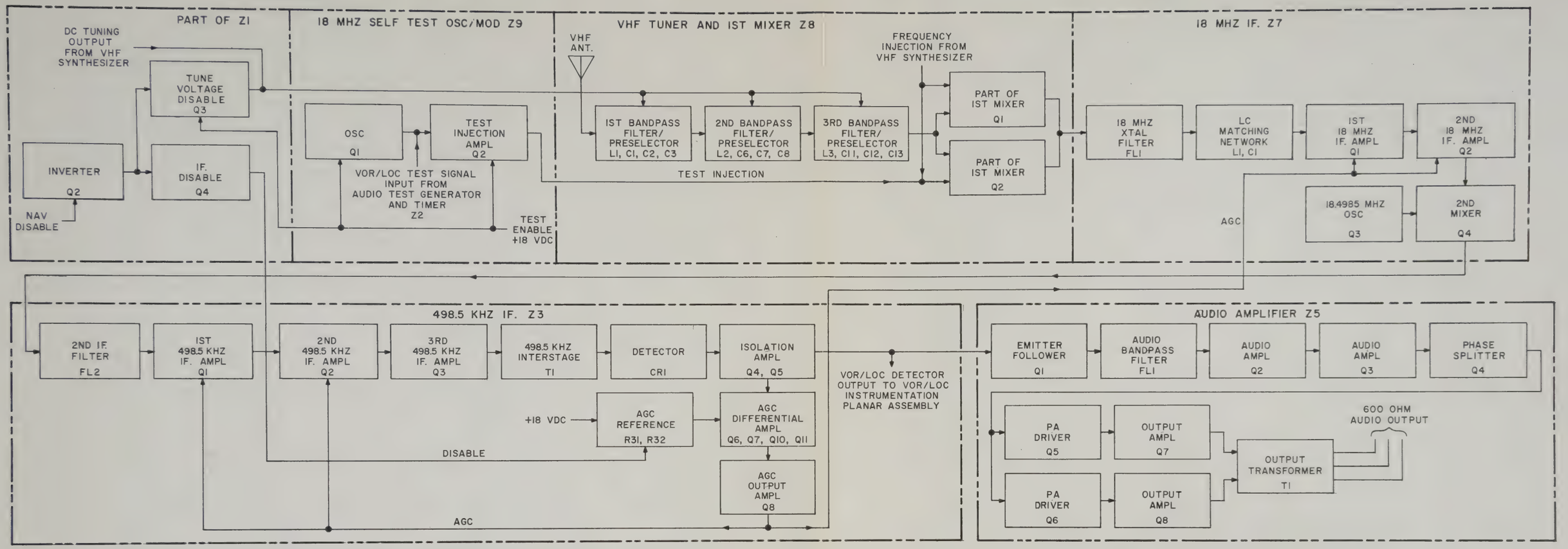
VHF Synthesizer Planar Assembly, Detailed Block Diagram
Figure 13

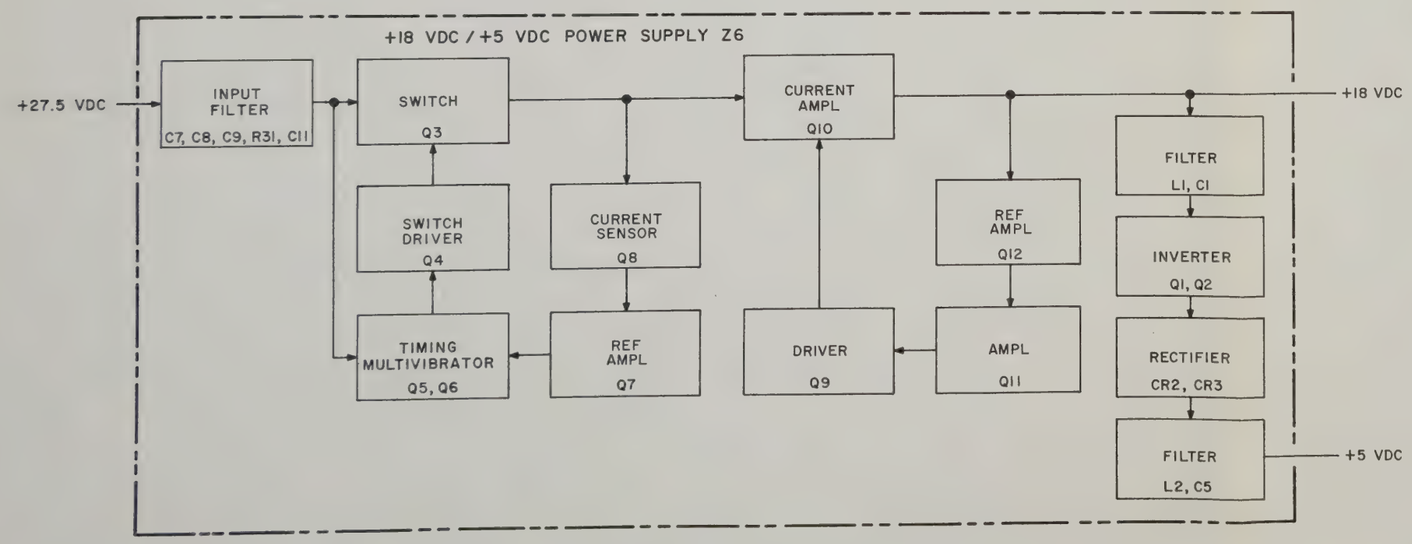

OUTPUT TUNING VOLTAGE
VHF SYN LOCK
NOTE:
NONSTANDARD ABBREVIATIONS
PW- PULSE WIDTH
VCO- VOLTAGE CONTROLLED OSCILLATOR
VCMO- VOLTAGE CONTROLLED MASTER OSCILLATOR
LOW-PASS FILTER
LOSS-OF-SIGNAL DET
LOCK INDICATOR OUTPUT Z9Q6
LOOP RESPONSE CONTROL Z9Q13
FAULT MONITOR DET
IMITER-AMPL Z9Q14-Z9Q15
ADDER NETWORK
FREQUENCY STANDARD
3.2MHZ OSC Z5Q1
BUFFER-AMPL Z5Q2
PULSE SHAPER Z4Q1
DIVIDER Z4 A1 THRU A7
FAULT MONITOR DET
25 KHZ REF (PW-200 NS)
25 KHZ REF (PW-5 US)
50 KHZ REF (TO UHF SYNTHESIZER)
LIMITER-AMPL Z6Q6-Z6Q8
LOW-PASS FILTER
LOCKED LOOP
POWER SOURCES
+5VDC
+5VDC
+18VDC
+18VDC
+16VDC
+16VDC REGULATOR Z3Q1-Z3Q4
TP0-3227-014

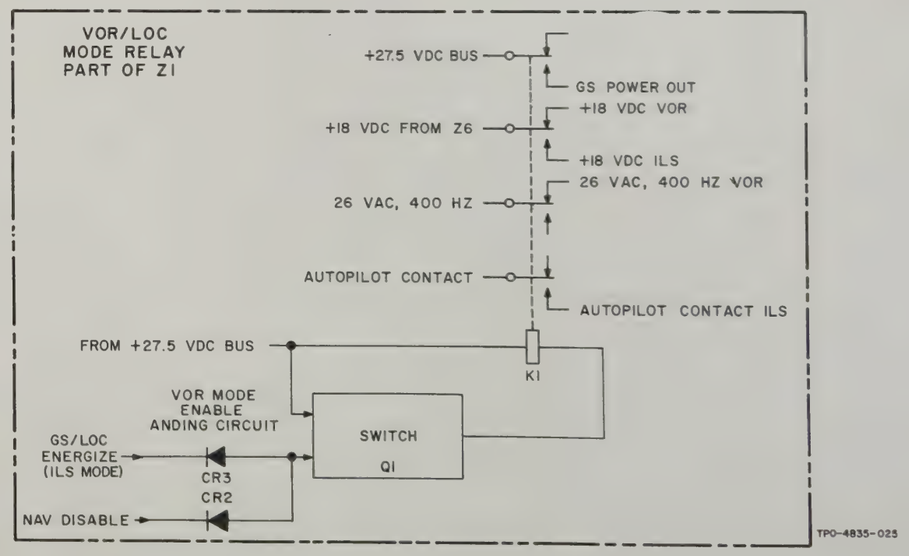

PART OF Z1
18 MHZ SELF TEST OSC/MOD Z9
VHF TUNER AND IST MIXER Z8
DC TUNING OUTPUT FROM VHF SYNTHESIZER
TUNE VOLTAGE DISABLE Q3
INVERTER Q2
IF. DISABLE Q4
NAV DISABLE
OSC Q1
TEST INJECTION AMPL Q2
VOR/LOC TEST SIGNAL INPUT FROM AUDIO TEST GENERATOR AND TIMER Z2
TEST ENABLE +18 VDC
VHF ANT.
IST BANDPASS FILTER/ PRESELECTOR L1, C1, C2, C3
2ND BANDPASS FILTER/ PRESELECTOR L2, C6, C7, C8
TEST INJECTION
498.5 KHZ IF. Z3
2ND IF. FILTER FL2
IST 498.5 KHZ IF. AMPL Q1
2ND 498.5 KHZ IF. AMPL Q2
3RD 498.5 KHZ IF. AMPL Q3
498.5 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6, Q7, Q10, Q11
DISABLE
AGC OUTPUT AMPL Q8
AGC
+18 VDC / +5 VDC POWER SUPPLY Z6
+27.5 VDC
INPUT FILTER C7, C8, C9, R31, C11
SWITCH Q3
CURRENT AMPL Q10
SWITCH DRIVER Q4
CURRENT SENSOR Q8
REF AMPL Q12
TIMING MULTIVIBRATOR Q5, Q6
REF AMPL Q7
DRIVER Q9
AMPL Q11
FILTER L1, C1
INVERTER Q1, Q2
RECTIFIER CR2, CR3
FILTER L2, C5

VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 1 of 2)
Figure 14

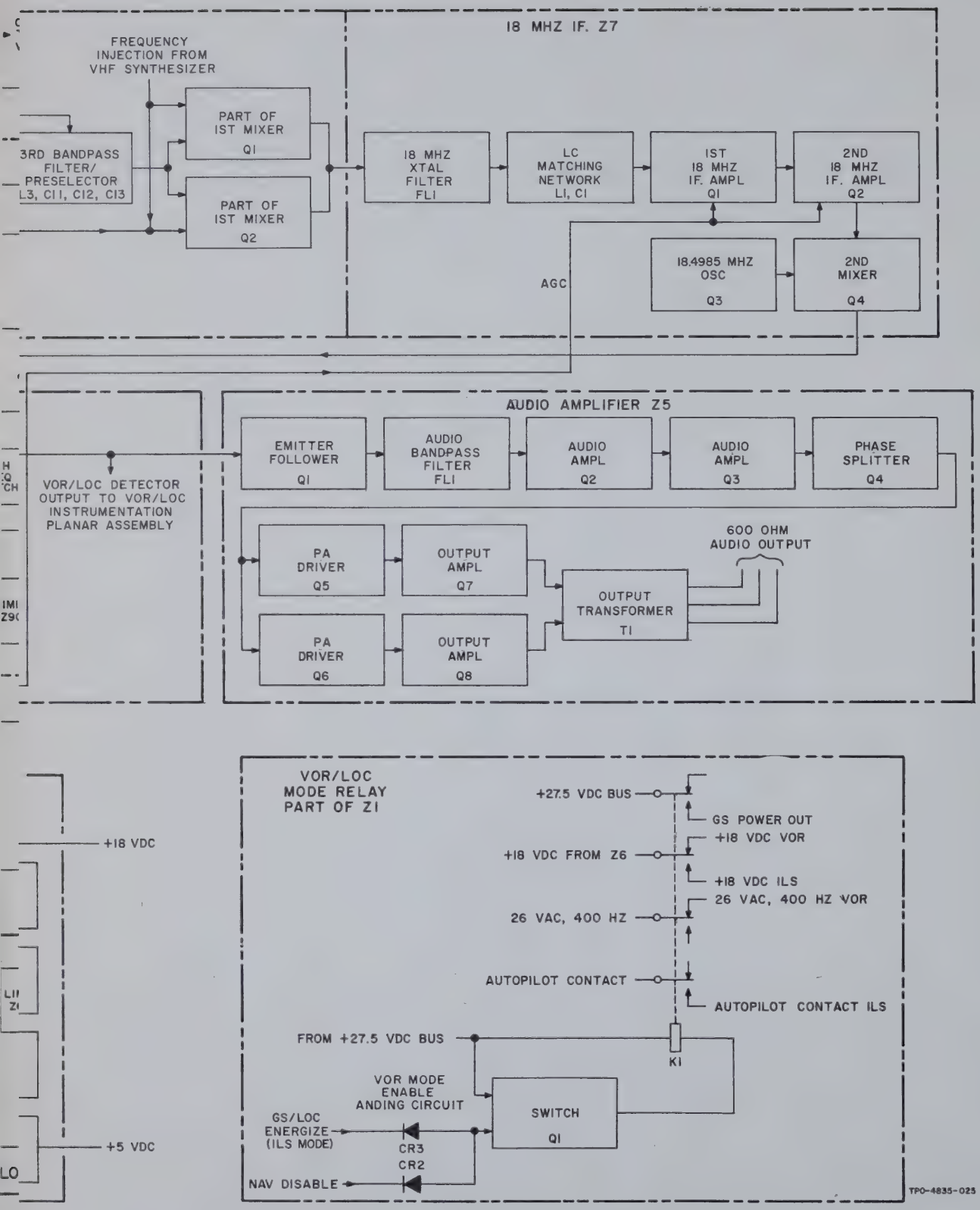

OUTPUT TUNING VOLTAGE
VHF SYN LOCK
NOTE:
NONSTANDARD ABBREVIATIONS
PW- PULSE WIDTH
VCO- VOLTAGE CONTROLLED OSCILLATOR
VCMO- VOLTAGE CONTROLLED MASTER OSCILLATOR
LOW-PASS FILTER
LOSS-OF-SIGNAL DET
LOCK INDICATOR OUTPUT Z9Q6
LOOP RESPONSE CONTROL Z9Q13
FAULT MONITOR DET
H Q CH
IMITER-AMPL Z9Q14-Z9Q15
ADDER NETWORK
FREQUENCY STANDARD
3.2MHZ OSC Z5Q1
BUFFER-AMPL Z5Q2
PULSE SHAPER Z4Q1
DIVIDER Z4 A1 THRU A7
FAULT MONITOR DET
25 KHZ REF (PW-200 NS)
25 KHZ REF (PW-5 US)
50 KHZ REF (TO UHF SYNTHESIZER)
LIMITER-AMPL Z6Q6-Z6Q8
LOW-PASS FILTER
LOCKED LOOP
POWER SOURCES
+5VDC
+5VDC
+18VDC
+18VDC
+16VDC
+16VDC REGULATOR Z3Q1-Z3Q4
TPO-3227-014

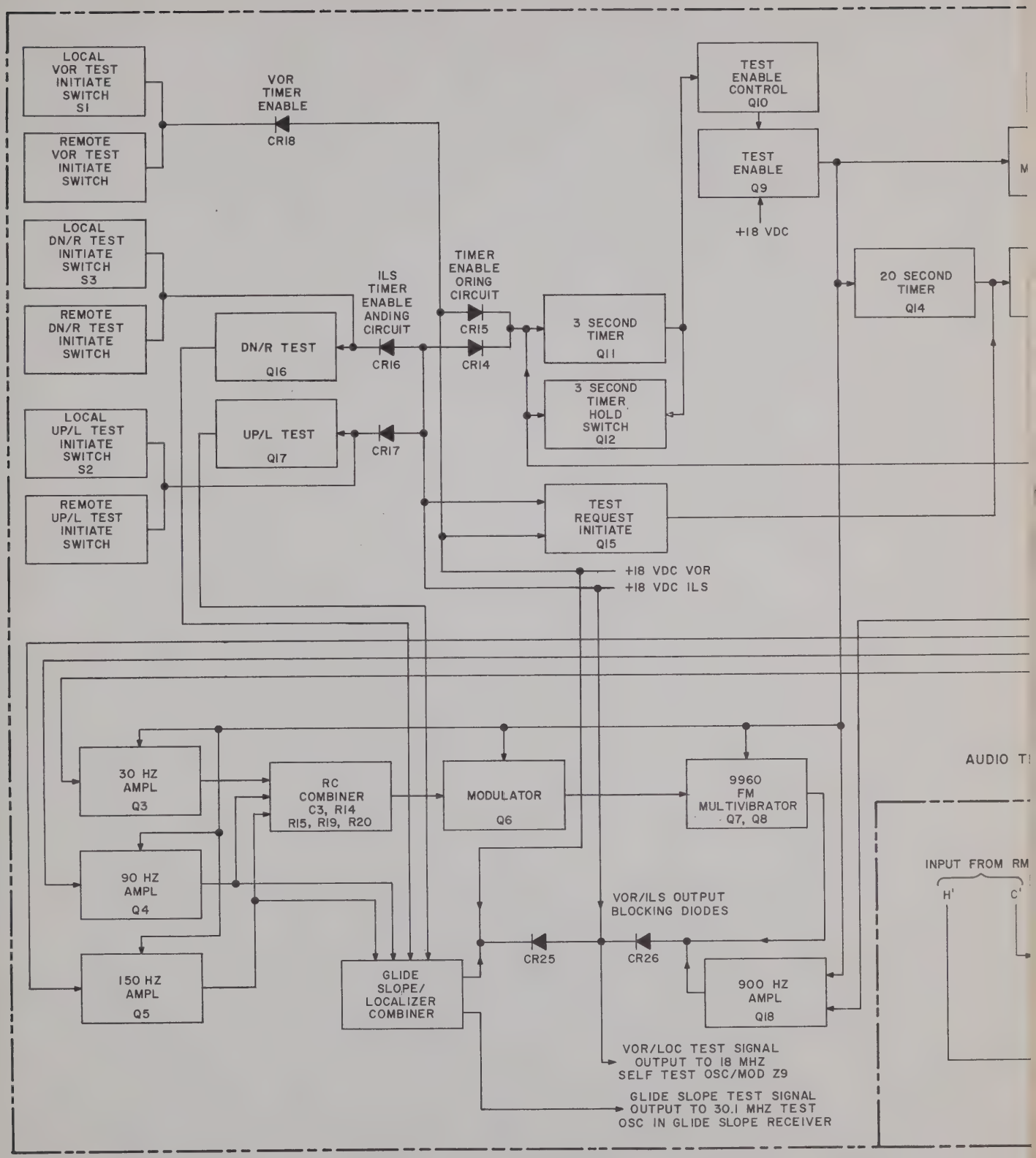

PART OF Z1
DC TUNING OUTPUT FROM VHF SYNTHESIZER
TUNE VOLTAGE DISABLE Q3
INVERTER Q2
IF. DISABLE Q4
NAV DISABLE
18 MHZ SELF TEST OSC/MOD Z9
OSC Q1
TEST INJECTION AMPL Q2
VOR/LOC TEST SIGNAL INPUT FROM AUDIO TEST GENERATOR AND TIMER Z2
TEST ENABLE +18 VDC
VHF TUNER AND IST MIXER Z8
VHF ANT.
IST BANDPASS FILTER/ PRESELECTOR L1, C1, C2, C3
2ND BANDPASS FILTER/ PRESELECTOR L2, C6, C7, C8
3RD BANDPASS FILTER/ PRESELECTOR L3, C11, C12, C13
FREQUENCY INJECTION FROM VHF SYNTHESIZER
PART OF IST MIXER Q1
PART OF IST MIXER Q2
TEST INJECTION
18 MHZ IF. Z7
18 MHZ XTAL FILTER FL1
LC MATCHING NETWORK L1, C1
IST 18 MHZ IF. AMPL Q1
2ND 18 MHZ IF. AMPL Q2
18.4985 MHZ OSC Q3
2ND MIXER Q4
AGC
498.5 KHZ IF. Z3
2ND IF FILTER FL2
IST 498.5 KHZ IF. AMPL Q1
2ND 498.5 KHZ IF. AMPL Q2
3RD 498.5 KHZ IF. AMPL Q3
498.5 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
VOR/LOC DETECTOR OUTPUT TO VOR/LOC INSTRUMENTATION PLANAR ASSEMBLY
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6, Q7, Q10, Q11
AGC OUTPUT AMPL Q8
DISABLE
AGC
AUDIO AMPLIFIER Z5
EMITTER FOLLOWER Q1
AUDIO BANDPASS FILTER FL1
AUDIO AMPL Q2
AUDIO AMPL Q3
PHASE SPLITTER Q4
PA DRIVER Q5
PA DRIVER Q6
OUTPUT AMPL Q7
OUTPUT AMPL Q8
OUTPUT TRANSFORMER T1
600 OHM AUDIO OUTPUT



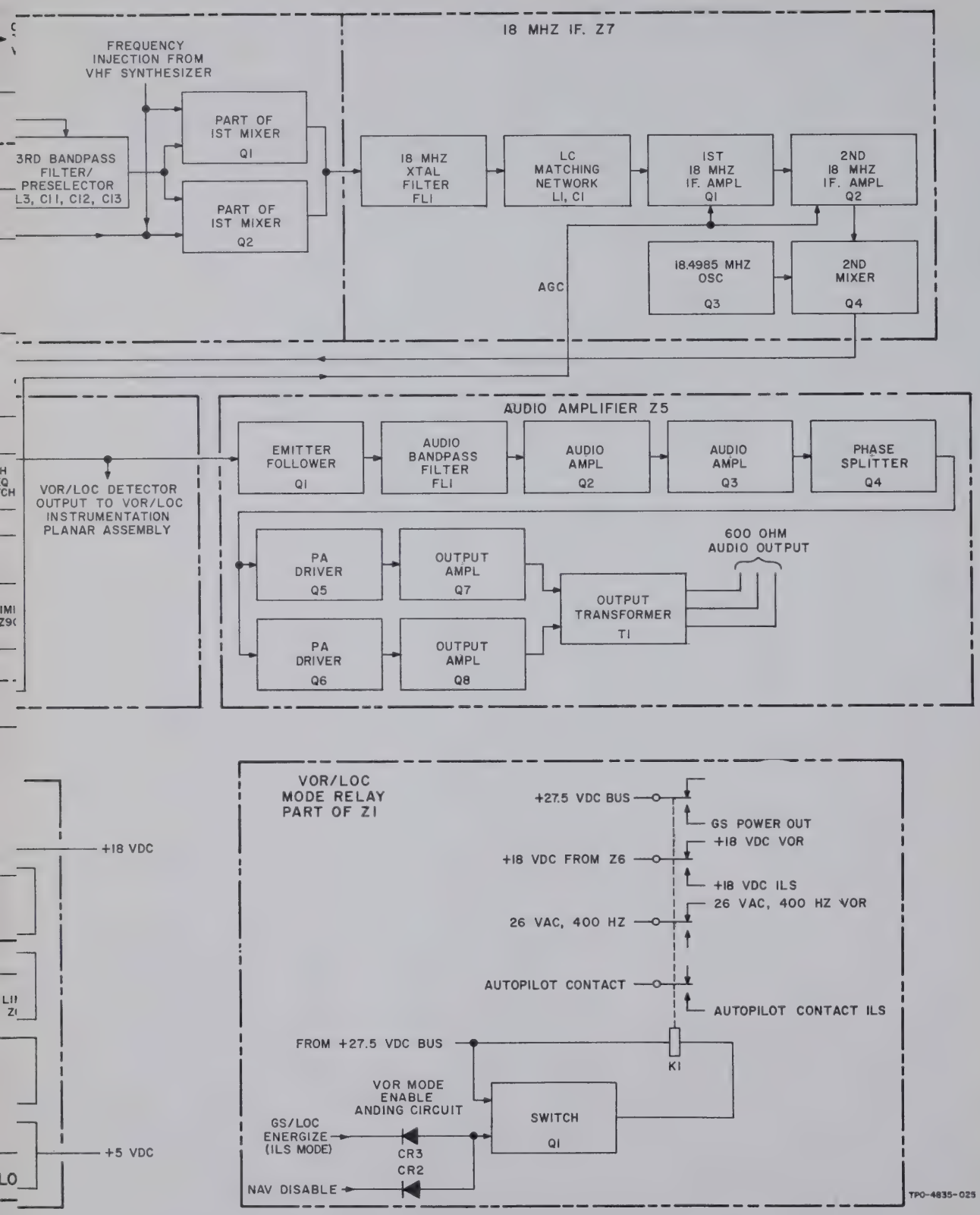


VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 1 of 2)
Figure 14

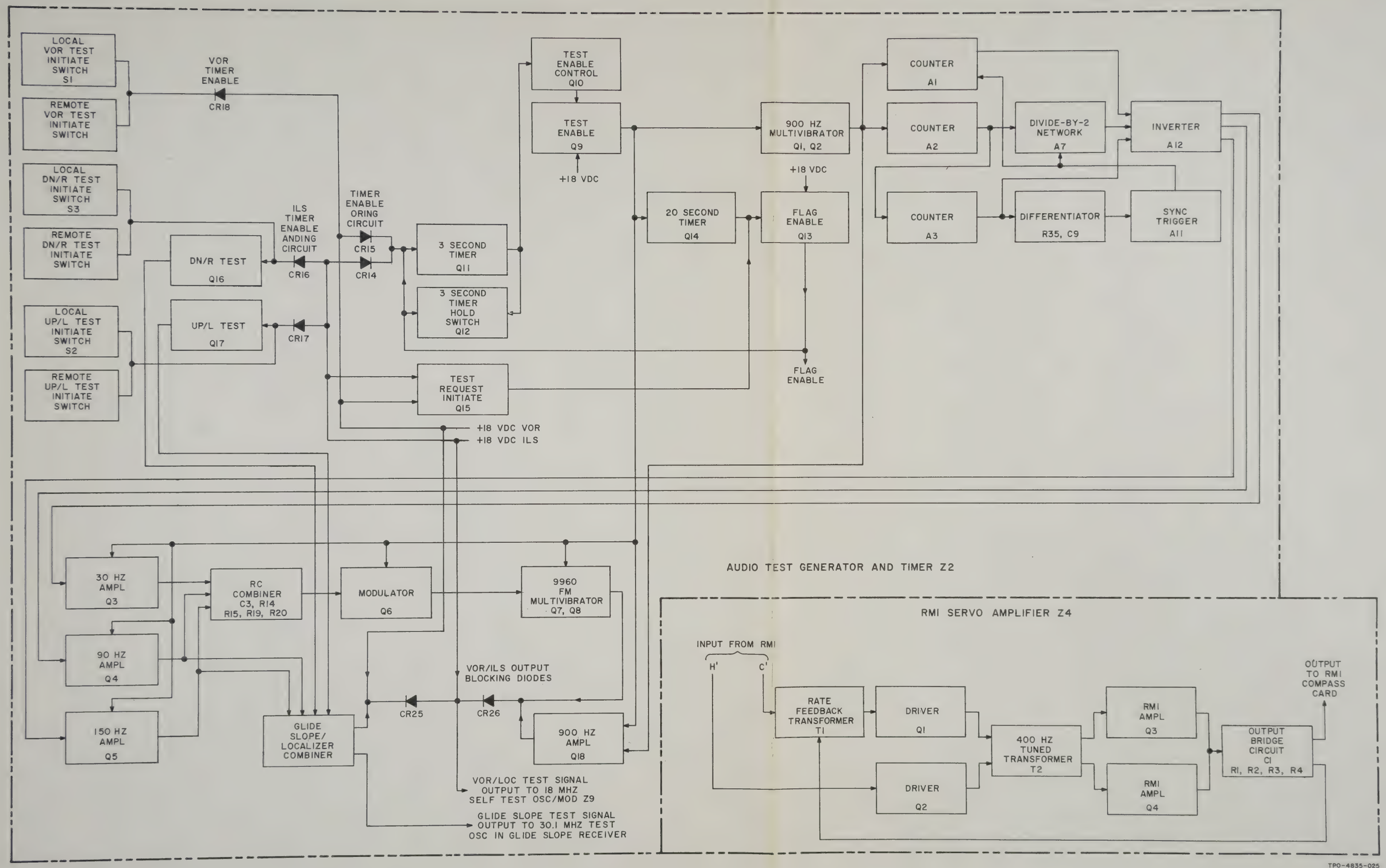

18 MHZ IF. Z7
FREQUENCY INJECTION FROM VHF SYNTHESIZER
3RD BANDPASS FILTER/ PRESELECTOR L3, C11, C12, C13
PART OF 1ST MIXER Q1
PART OF 1ST MIXER Q2
18 MHZ XTAL FILTER FL1
LC MATCHING NETWORK L1, C1
1ST 18 MHZ IF. AMPL Q1
2ND 18 MHZ IF. AMPL Q2
18.4985 MHZ OSC Q3
2ND MIXER Q4
AGC
AUDIO AMPLIFIER Z5
EMITTER FOLLOWER Q1
AUDIO BANDPASS FILTER FL1
AUDIO AMPL Q2
AUDIO AMPL Q3
PHASE SPLITTER Q4
VOR/LOC DETECTOR OUTPUT TO VOR/LOC INSTRUMENTATION PLANAR ASSEMBLY
PA DRIVER Q5
PA DRIVER Q6
OUTPUT AMPL Q7
OUTPUT AMPL Q8
OUTPUT TRANSFORMER T1
600 OHM AUDIO OUTPUT
+18 VDC
+5 VDC
VOR/LOC MODE RELAY PART OF Z1
+27.5 VDC BUS
GS POWER OUT
+18 VDC VOR
+18 VDC FROM Z6
+18 VDC ILS
26 VAC, 400 HZ VOR
26 VAC, 400 HZ
AUTOPILOT CONTACT
AUTOPILOT CONTACT ILS
FROM +27.5 VDC BUS
K1
VOR MODE ENABLE ANDING CIRCUIT
SWITCH Q1
GS/LOC ENERGIZE (ILS MODE)
CR3
CR2
NAV DISABLE
TPO-4835-025



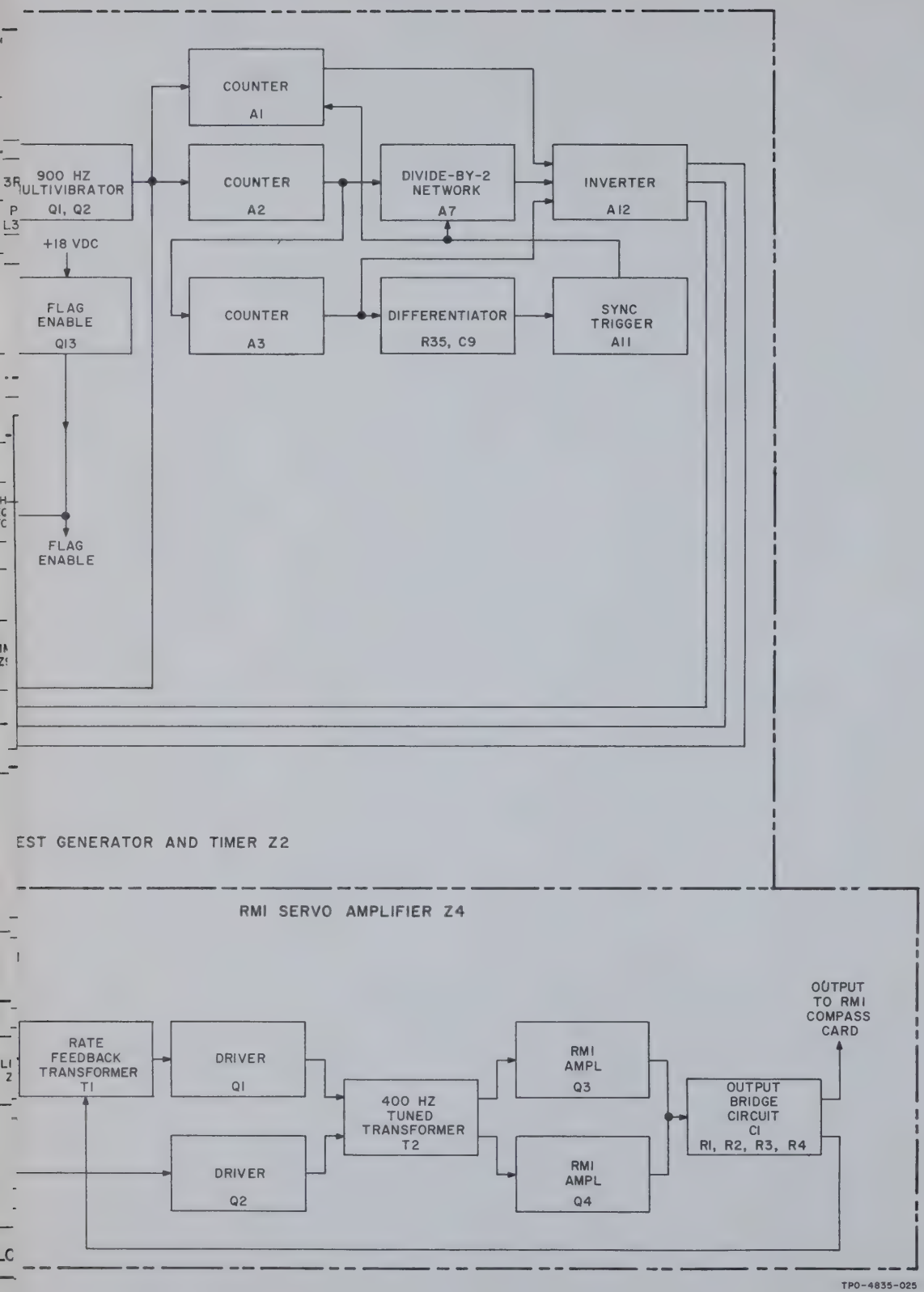
VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 2 of 2)
Figure 14


18 MHZ IF. Z7
FREQUENCY INJECTION FROM VHF SYNTHESIZER
3RD BANDPASS FILTER/ PRESELECTOR L3, C11, C12, C13
PART OF 1ST MIXER Q1
PART OF 1ST MIXER Q2
18 MHZ XTAL FILTER FL1
LC MATCHING NETWORK L1, C1
1ST 18 MHZ IF. AMPL Q1
2ND 18 MHZ IF. AMPL Q2
18.4985 MHZ OSC Q3
2ND MIXER Q4
AGC
AUDIO AMPLIFIER Z5
VOR/LOC DETECTOR OUTPUT TO VOR/LOC INSTRUMENTATION PLANAR ASSEMBLY
EMITTER FOLLOWER Q1
AUDIO BANDPASS FILTER FL1
AUDIO AMPL Q2
AUDIO AMPL Q3
PHASE SPLITTER Q4
PA DRIVER Q5
PA DRIVER Q6
OUTPUT AMPL Q7
OUTPUT AMPL Q8
OUTPUT TRANSFORMER T1
600 OHM AUDIO OUTPUT

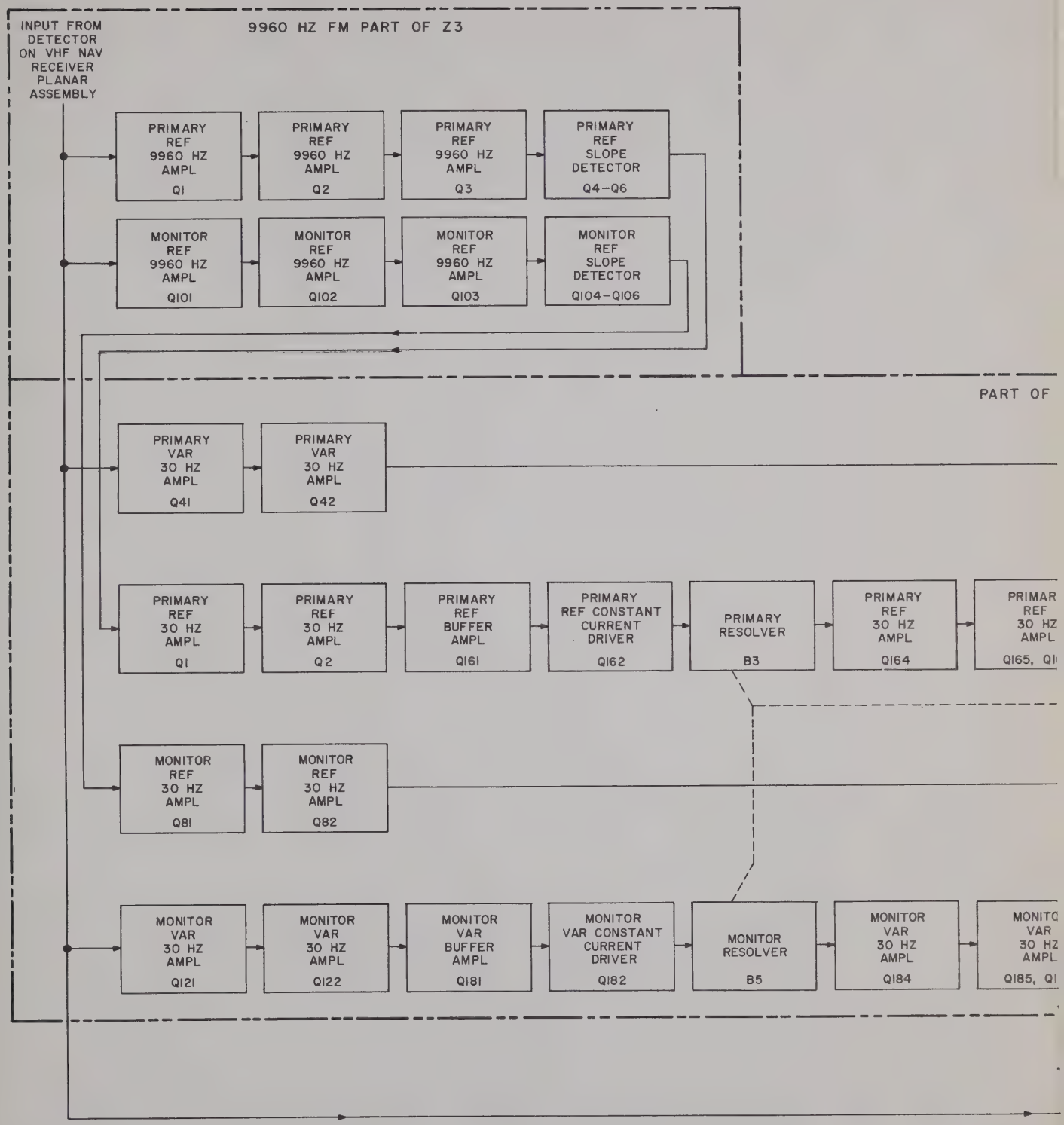
+18 VDC
+5 VDC
VOR/LOC MODE RELAY PART OF Z1
+27.5 VDC BUS
GS POWER OUT
+18 VDC VOR
+18 VDC FROM Z6
+18 VDC ILS
26 VAC, 400 HZ VOR
26 VAC, 400 HZ
AUTOPILOT CONTACT
AUTOPILOT CONTACT ILS
FROM +27.5 VDC BUS
K1
VOR MODE ENABLE ANDING CIRCUIT
SWITCH Q1
GS/LOC ENERGIZE (ILS MODE)
CR3
CR2
NAV DISABLE
TPO-4835-025



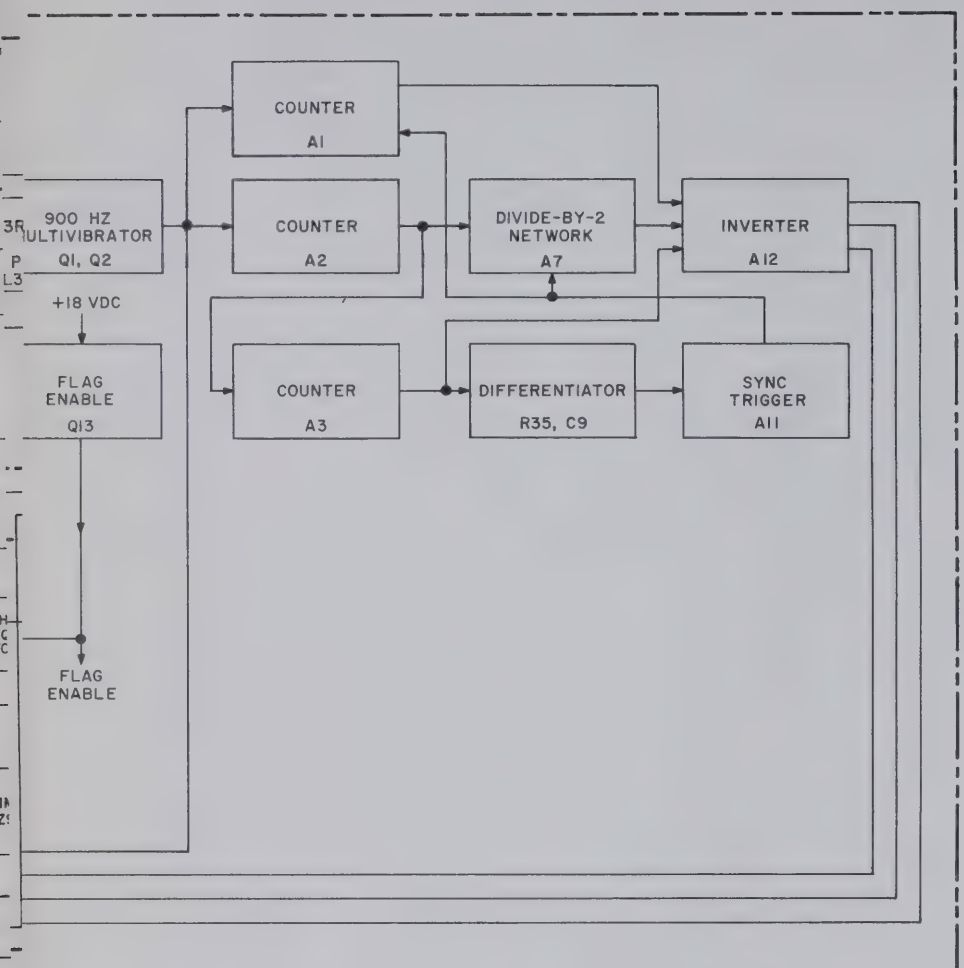
VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 2 of 2)
Figure 14


COUNTER
A1
900 HZ
MULTIVIBRATOR
Q1, Q2
COUNTER
A2
DIVIDE-BY-2
NETWORK
A7
INVERTER
A12
+18 VDC
FLAG
ENABLE
Q13
COUNTER
A3
DIFFERENTIATOR
R35, C9
SYNC
TRIGGER
A11
FLAG
ENABLE
EST GENERATOR AND TIMER Z2
RMI SERVO AMPLIFIER Z4
OUTPUT
TO RMI
COMPASS
CARD
RATE
FEEDBACK
TRANSFORMER
T1
DRIVER
Q1
DRIVER
Q2
400 HZ
TUNED
TRANSFORMER
T2
RMI
AMPL
Q3
RMI
AMPL
Q4
OUTPUT
BRIDGE
CIRCUIT
C1
R1, R2, R3, R4

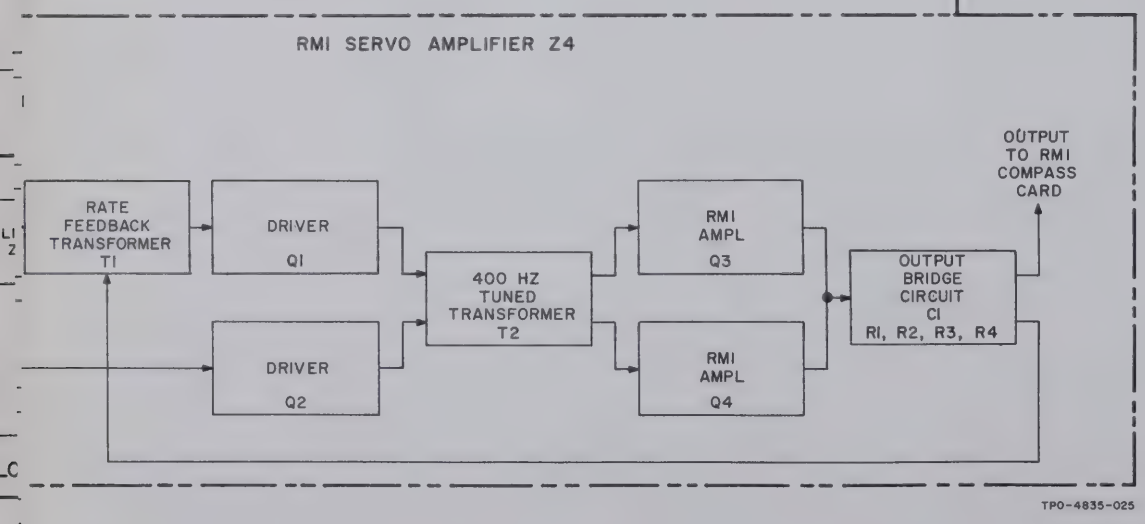
TPO-4835-025


INPUT FROM DETECTOR ON VHF NAV RECEIVER PLANAR ASSEMBLY
9960 HZ FM PART OF Z3
PRIMARY REF 9960 HZ AMPL Q1
PRIMARY REF 9960 HZ AMPL Q2
PRIMARY REF 9960 HZ AMPL Q3
PRIMARY REF SLOPE DETECTOR Q4-Q6
MONITOR REF 9960 HZ AMPL Q101
MONITOR REF 9960 HZ AMPL Q102
MONITOR REF 9960 HZ AMPL Q103
MONITOR REF SLOPE DETECTOR Q104-Q106
PART OF
PRIMARY VAR 30 HZ AMPL Q41
PRIMARY VAR 30 HZ AMPL Q42
PRIMARY REF 30 HZ AMPL Q1
PRIMARY REF 30 HZ AMPL Q2
PRIMARY REF BUFFER AMPL Q161
PRIMARY REF CONSTANT CURRENT DRIVER Q162
PRIMARY RESOLVER B3
PRIMARY REF 30 HZ AMPL Q164
PRIMAR REF 30 HZ AMPL Q165, Q1
MONITOR REF 30 HZ AMPL Q81
MONITOR REF 30 HZ AMPL Q82
MONITOR VAR 30 HZ AMPL Q121
MONITOR VAR 30 HZ AMPL Q122
MONITOR VAR BUFFER AMPL Q181
MONITOR VAR CONSTANT CURRENT DRIVER Q182
MONITOR RESOLVER B5
MONITOR VAR 30 HZ AMPL Q184
MONITO VAR 30 HZ AMPL Q185, Q1

VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 1 of 3)
Figure 15



EST GENERATOR AND TIMER Z2



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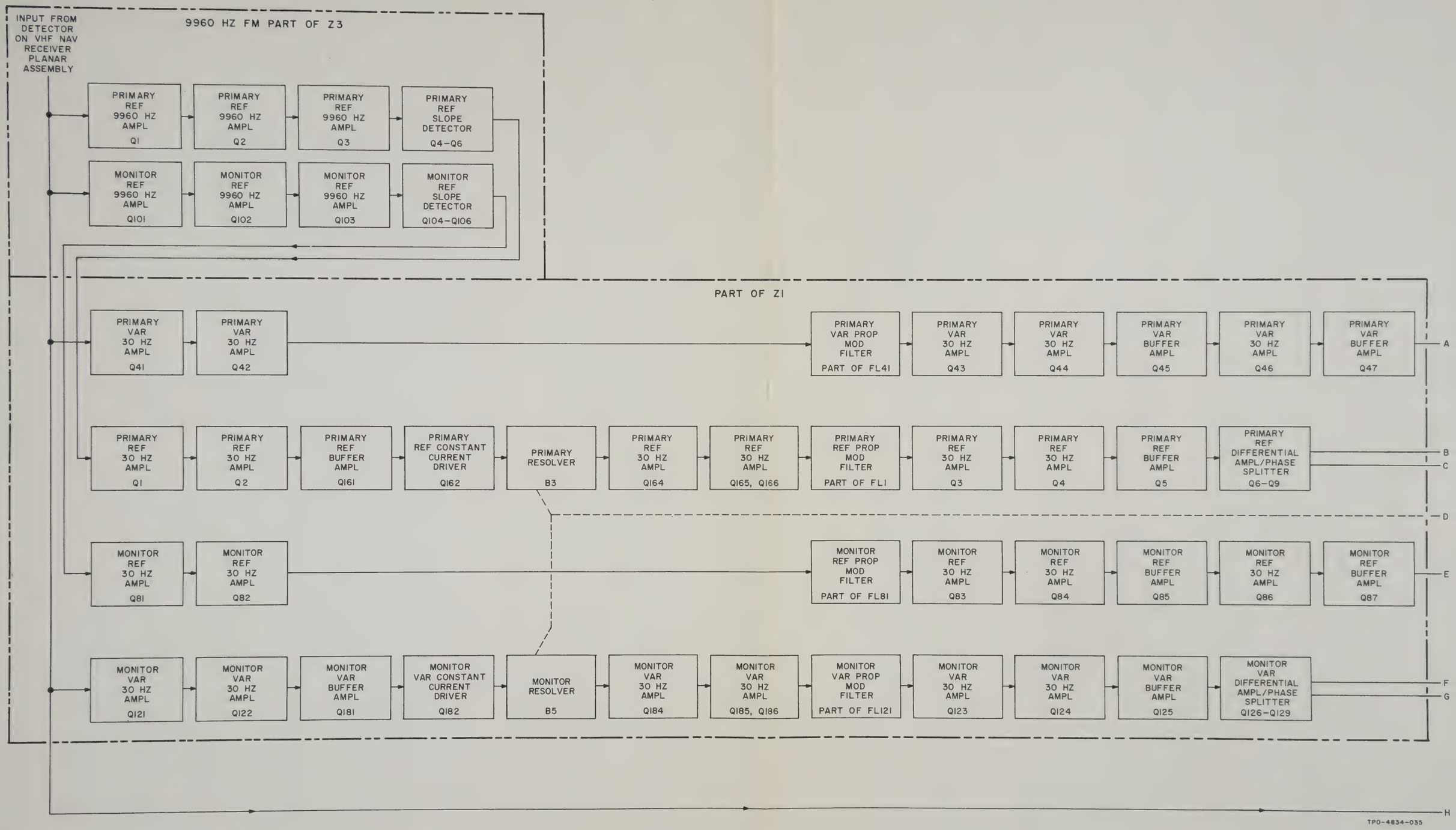
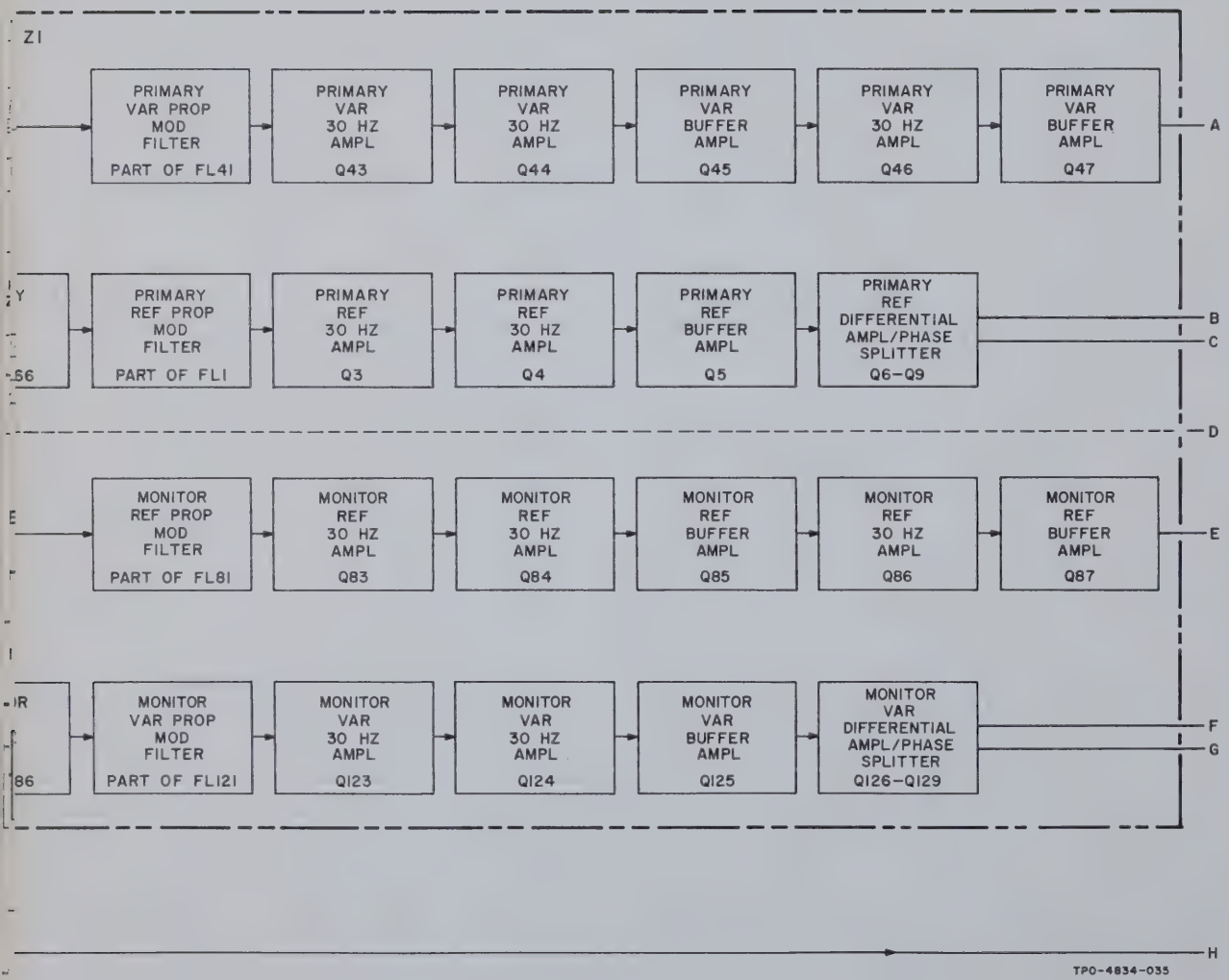
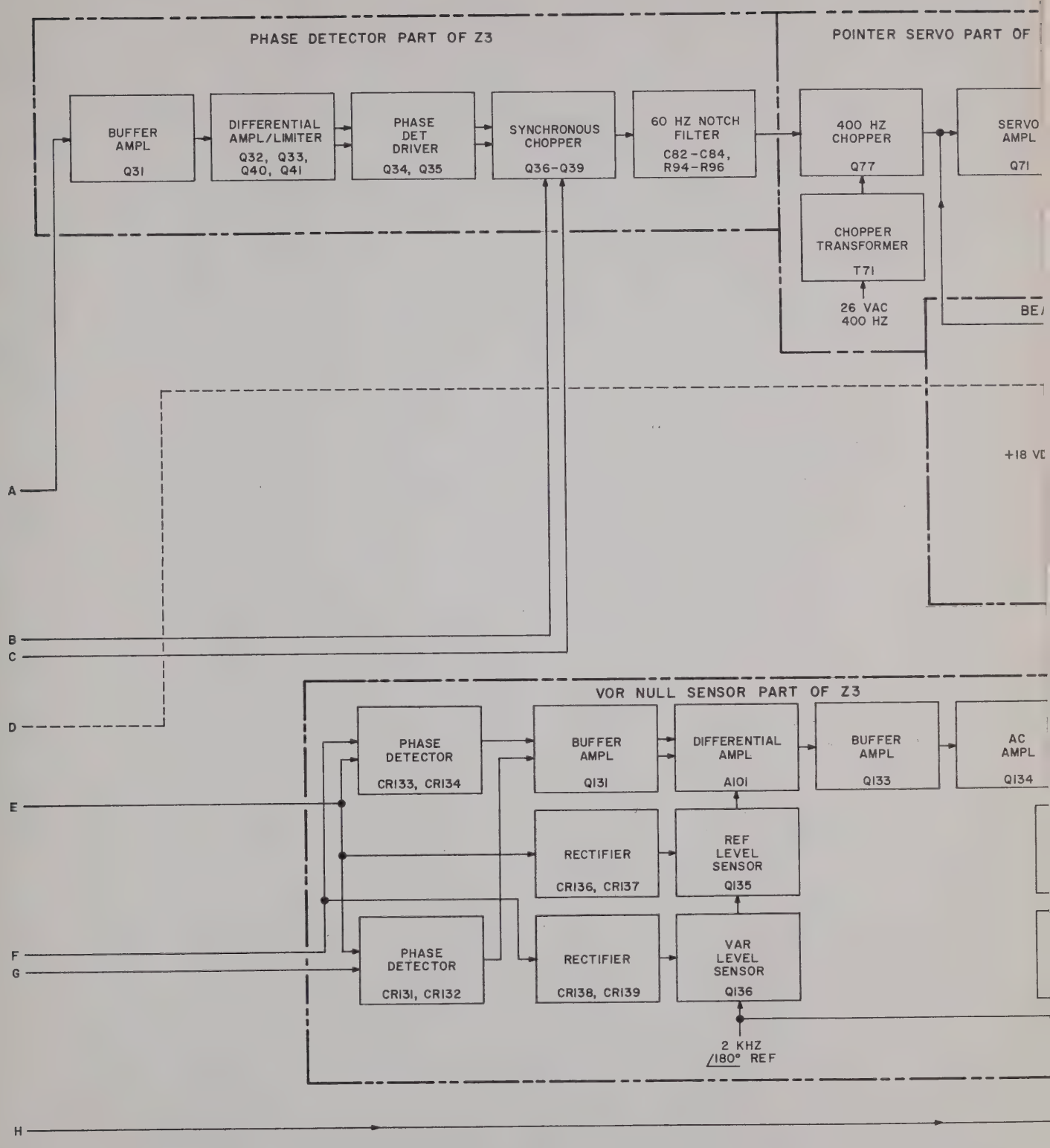
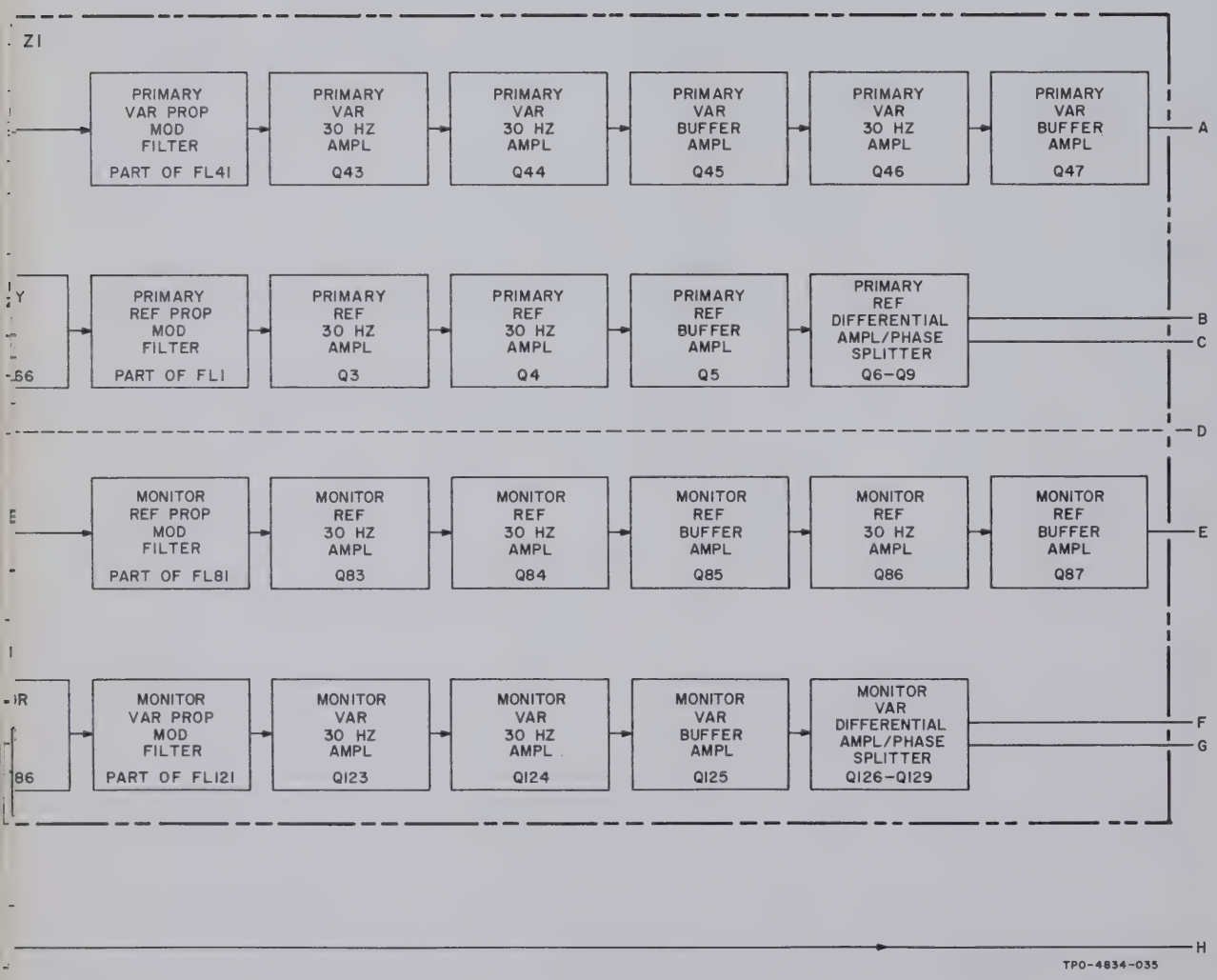

INPUT FROM DETECTOR ON VHF NAV RECEIVER PLANAR ASSEMBLY
9960 HZ FM PART OF Z3
PRIMARY REF 9960 HZ AMPL Q1
PRIMARY REF 9960 HZ AMPL Q2
PRIMARY REF 9960 HZ AMPL Q3
PRIMARY REF SLOPE DETECTOR Q4-Q6
MONITOR REF 9960 HZ AMPL Q101
MONITOR REF 9960 HZ AMPL Q102
MONITOR REF 9960 HZ AMPL Q103
MONITOR REF SLOPE DETECTOR Q104-Q106
PART OF Z1
PRIMARY VAR 30 HZ AMPL Q41
PRIMARY VAR 30 HZ AMPL Q42
PRIMARY VAR PROP MOD FILTER PART OF FL41
PRIMARY VAR 30 HZ AMPL Q43
PRIMARY VAR 30 HZ AMPL Q44
PRIMARY VAR BUFFER AMPL Q45
PRIMARY VAR 30 HZ AMPL Q46
PRIMARY VAR BUFFER AMPL Q47
A
PRIMARY REF 30 HZ AMPL Q1
PRIMARY REF 30 HZ AMPL Q2
PRIMARY REF BUFFER AMPL Q161
PRIMARY REF CONSTANT CURRENT DRIVER Q162
PRIMARY RESOLVER B3
PRIMARY REF 30 HZ AMPL Q164
PRIMARY REF 30 HZ AMPL Q165, Q166
PRIMARY REF PROP MOD FILTER PART OF FL1
PRIMARY REF 30 HZ AMPL Q3
PRIMARY REF 30 HZ AMPL Q4
PRIMARY REF BUFFER AMPL Q5
PRIMARY REF DIFFERENTIAL AMPL/PHASE SPLITTER Q6-Q9
B
C
D
MONITOR REF 30 HZ AMPL Q81
MONITOR REF 30 HZ AMPL Q82
MONITOR REF PROP MOD FILTER PART OF FL81
MONITOR REF 30 HZ AMPL Q83
MONITOR REF 30 HZ AMPL Q84
MONITOR REF BUFFER AMPL Q85
MONITOR REF 30 HZ AMPL Q86
MONITOR REF BUFFER AMPL Q87
E
MONITOR VAR 30 HZ AMPL Q121
MONITOR VAR 30 HZ AMPL Q122
MONITOR VAR BUFFER AMPL Q181
MONITOR VAR CONSTANT CURRENT DRIVER Q182
MONITOR RESOLVER B5
MONITOR VAR 30 HZ AMPL Q184
MONITOR VAR 30 HZ AMPL Q185, Q186
MONITOR VAR PROP MOD FILTER PART OF FL121
MONITOR VAR 30 HZ AMPL Q123
MONITOR VAR 30 HZ AMPL Q124
MONITOR VAR BUFFER AMPL Q125
MONITOR VAR DIFFERENTIAL AMPL/PHASE SPLITTER Q126-Q129
F
G
H
TPO-4834-035

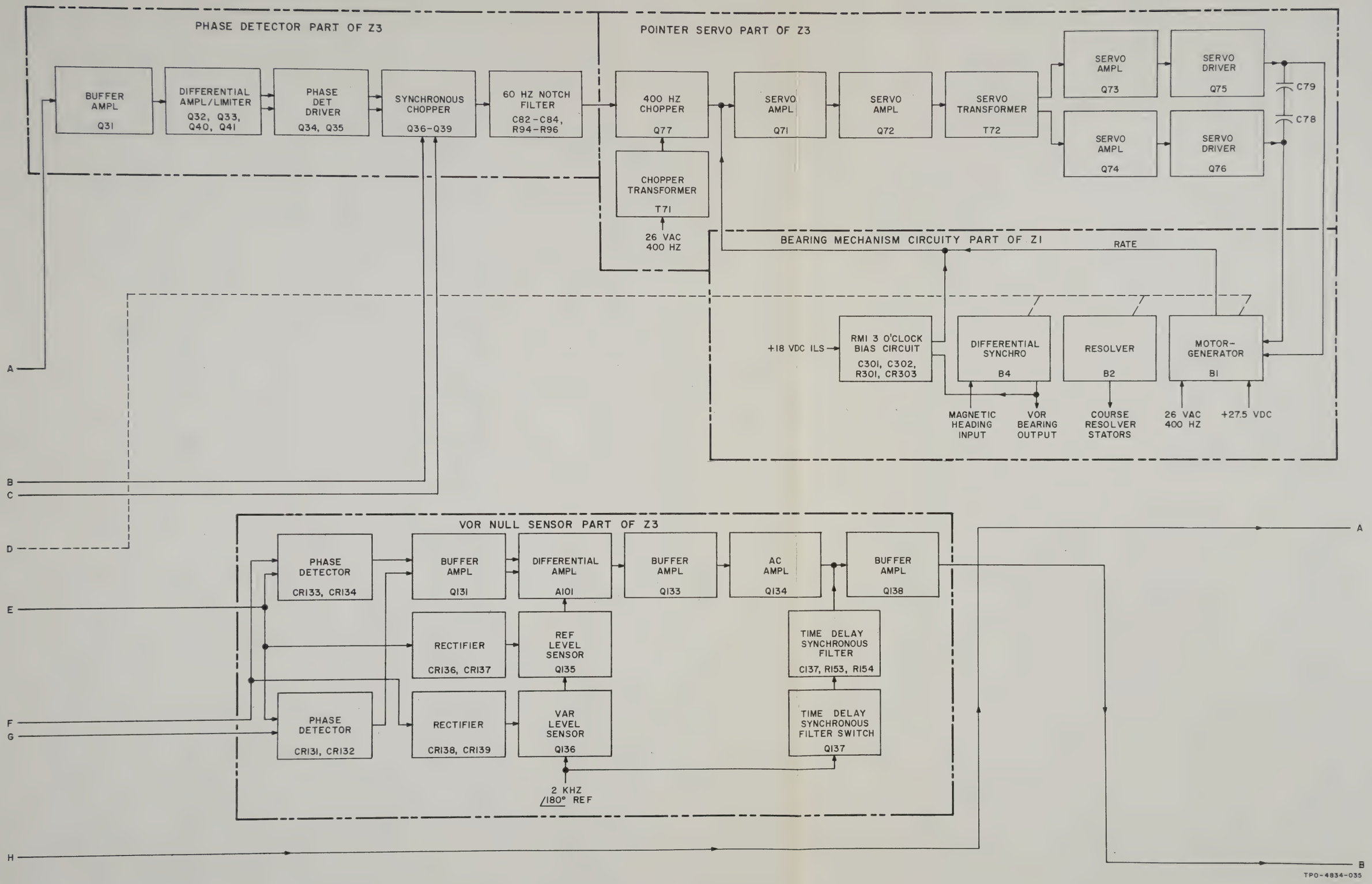
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 1 of 3)
Figure 15


Z1
PRIMARY VAR PROP MOD FILTER PART OF FL41
PRIMARY VAR 30 HZ AMPL Q43
PRIMARY VAR 30 HZ AMPL Q44
PRIMARY VAR BUFFER AMPL Q45
PRIMARY VAR 30 HZ AMPL Q46
PRIMARY VAR BUFFER AMPL Q47
A
PRIMARY REF PROP MOD FILTER PART OF FL1
PRIMARY REF 30 HZ AMPL Q3
PRIMARY REF 30 HZ AMPL Q4
PRIMARY REF BUFFER AMPL Q5
PRIMARY REF DIFFERENTIAL AMPL/PHASE SPLITTER Q6–Q9
B
C
D
MONITOR REF PROP MOD FILTER PART OF FL81
MONITOR REF 30 HZ AMPL Q83
MONITOR REF 30 HZ AMPL Q84
MONITOR REF BUFFER AMPL Q85
MONITOR REF 30 HZ AMPL Q86
MONITOR REF BUFFER AMPL Q87
E
MONITOR VAR PROP MOD FILTER PART OF FL121
MONITOR VAR 30 HZ AMPL Q123
MONITOR VAR 30 HZ AMPL Q124
MONITOR VAR BUFFER AMPL Q125
MONITOR VAR DIFFERENTIAL AMPL/PHASE SPLITTER Q126–Q129
F
G
H
TP0-4834-035

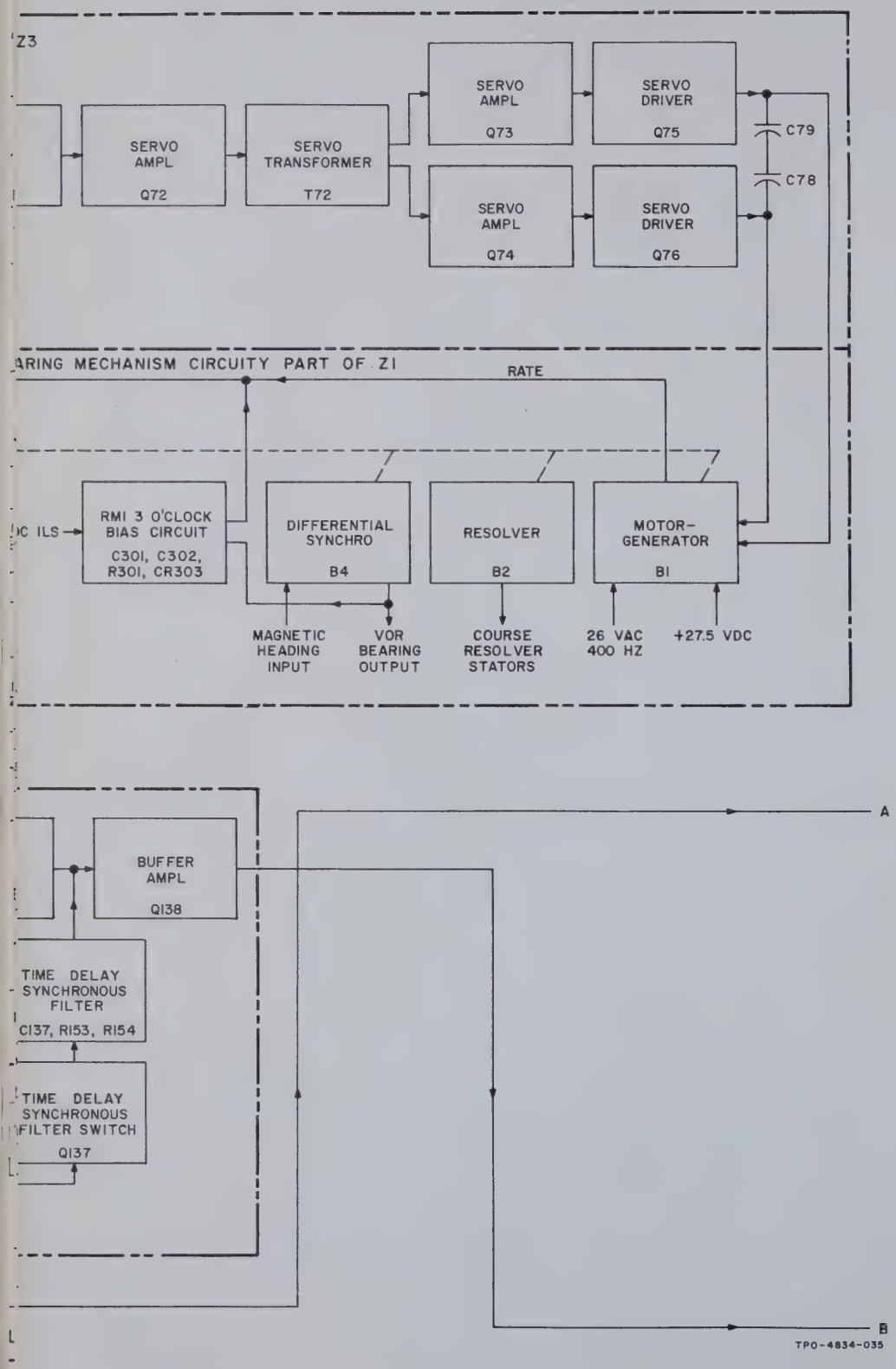


VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 2 of 3)
Figure 15


Z1
PRIMARY VAR PROP MOD FILTER PART OF FL41
PRIMARY VAR 30 HZ AMPL Q43
PRIMARY VAR 30 HZ AMPL Q44
PRIMARY VAR BUFFER AMPL Q45
PRIMARY VAR 30 HZ AMPL Q46
PRIMARY VAR BUFFER AMPL Q47
A
PRIMARY REF PROP MOD FILTER PART OF FL1
PRIMARY REF 30 HZ AMPL Q3
PRIMARY REF 30 HZ AMPL Q4
PRIMARY REF BUFFER AMPL Q5
PRIMARY REF DIFFERENTIAL AMPL/PHASE SPLITTER Q6–Q9
B
C
D
MONITOR REF PROP MOD FILTER PART OF FL81
MONITOR REF 30 HZ AMPL Q83
MONITOR REF 30 HZ AMPL Q84
MONITOR REF BUFFER AMPL Q85
MONITOR REF 30 HZ AMPL Q86
MONITOR REF BUFFER AMPL Q87
E
MONITOR VAR PROP MOD FILTER PART OF FL121
MONITOR VAR 30 HZ AMPL Q123
MONITOR VAR 30 HZ AMPL Q124
MONITOR VAR BUFFER AMPL Q125
MONITOR VAR DIFFERENTIAL AMPL/PHASE SPLITTER Q126–Q129
F
G
H
TPO-4834-035



VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 2 of 3)
Figure 15


Z3
SERVO AMPL Q72
SERVO TRANSFORMER T72
SERVO AMPL Q73
SERVO AMPL Q74
SERVO DRIVER Q75
SERVO DRIVER Q76
C79
C78
ARING MECHANISM CIRCUITY PART OF ZI
RATE
OC ILS
RMI 3 O'CLOCK BIAS CIRCUIT C301, C302, R301, CR303
DIFFERENTIAL SYNCHRO B4
RESOLVER B2
MOTOR-GENERATOR B1
MAGNETIC HEADING INPUT
VOR BEARING OUTPUT
COURSE RESOLVER STATORS
26 VAC 400 HZ
+27.5 VDC
BUFFER AMPL Q138
TIME DELAY SYNCHRONOUS FILTER C137, R153, R154
TIME DELAY SYNCHRONOUS FILTER SWITCH Q137
A
B

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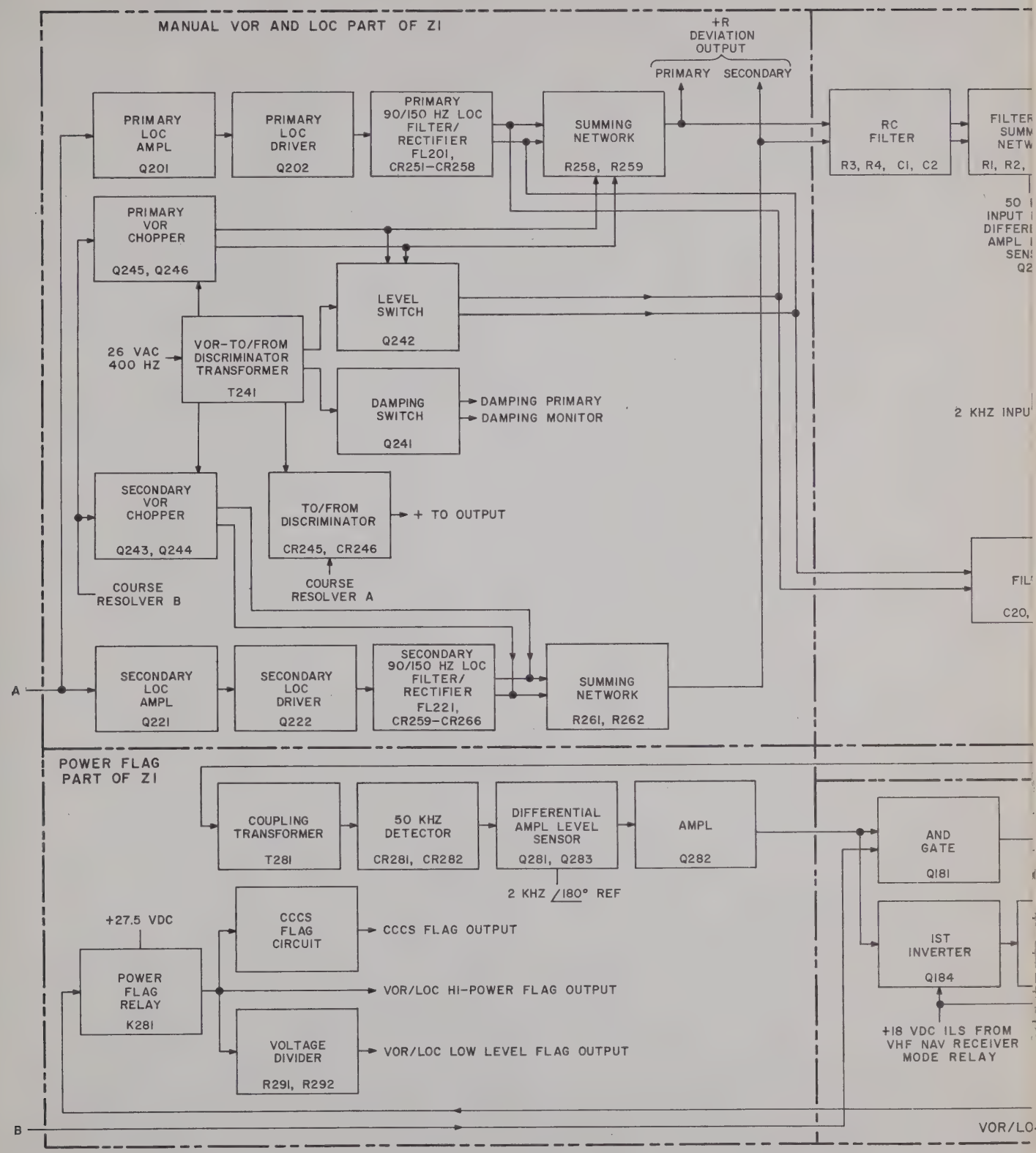
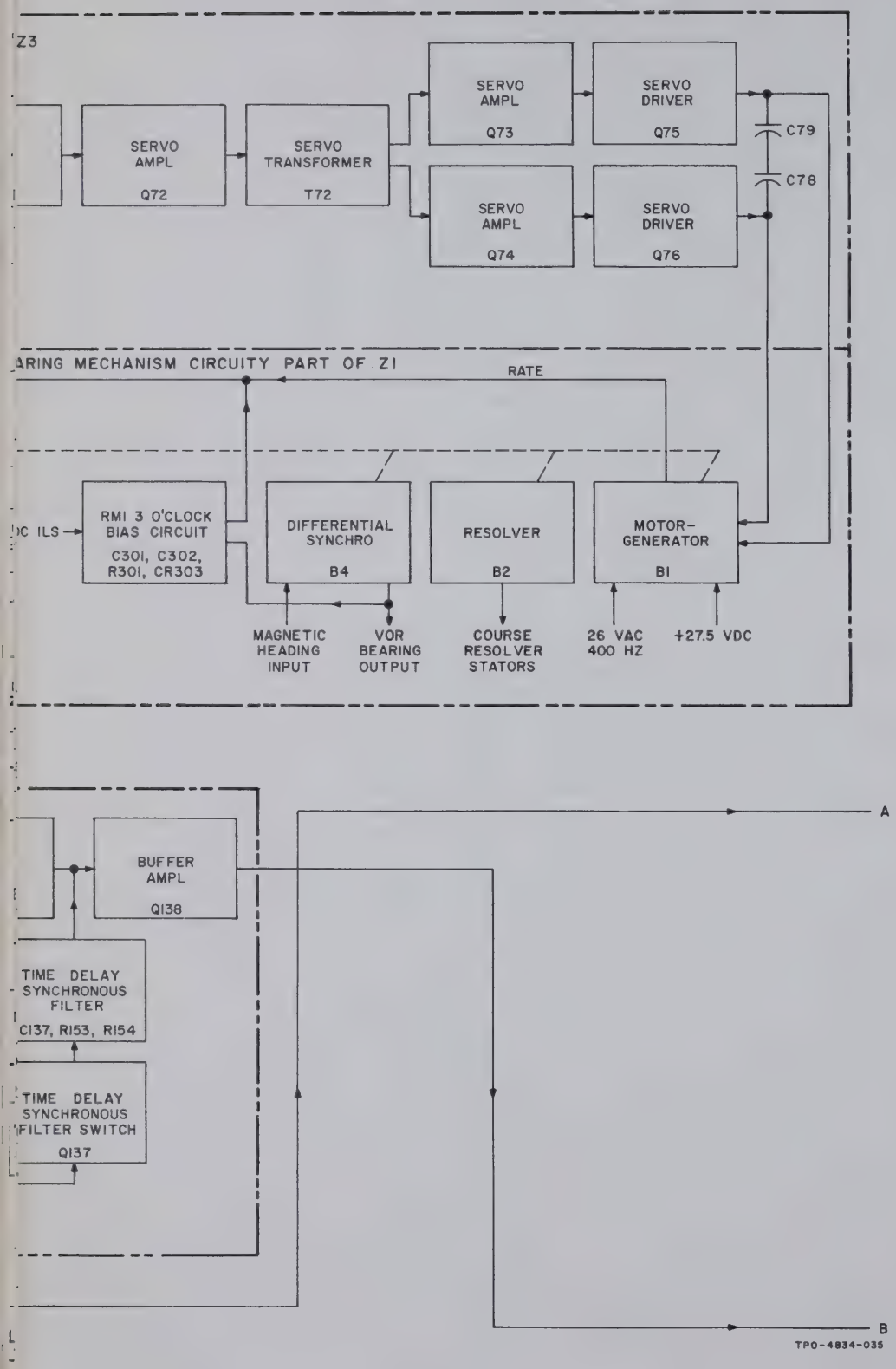
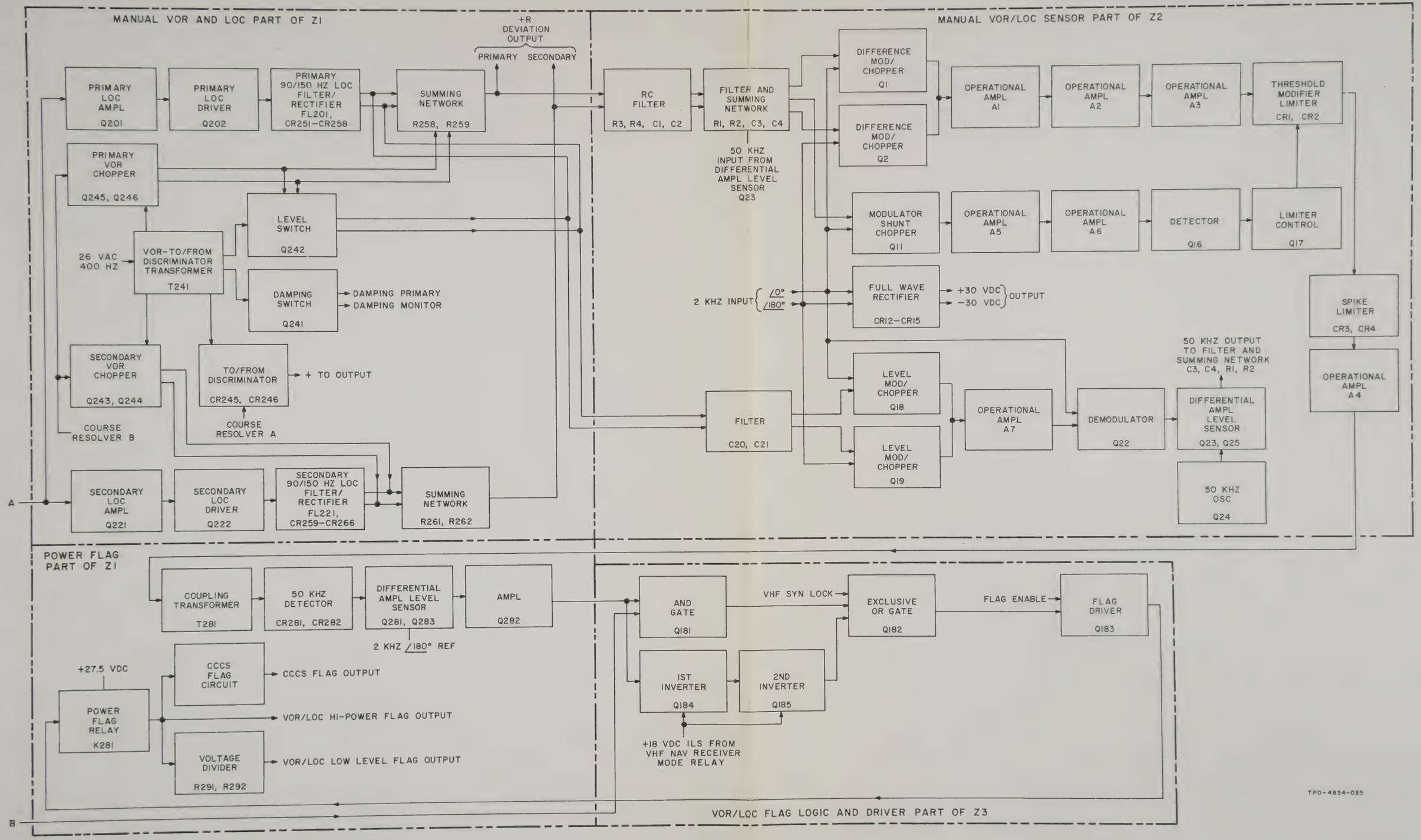


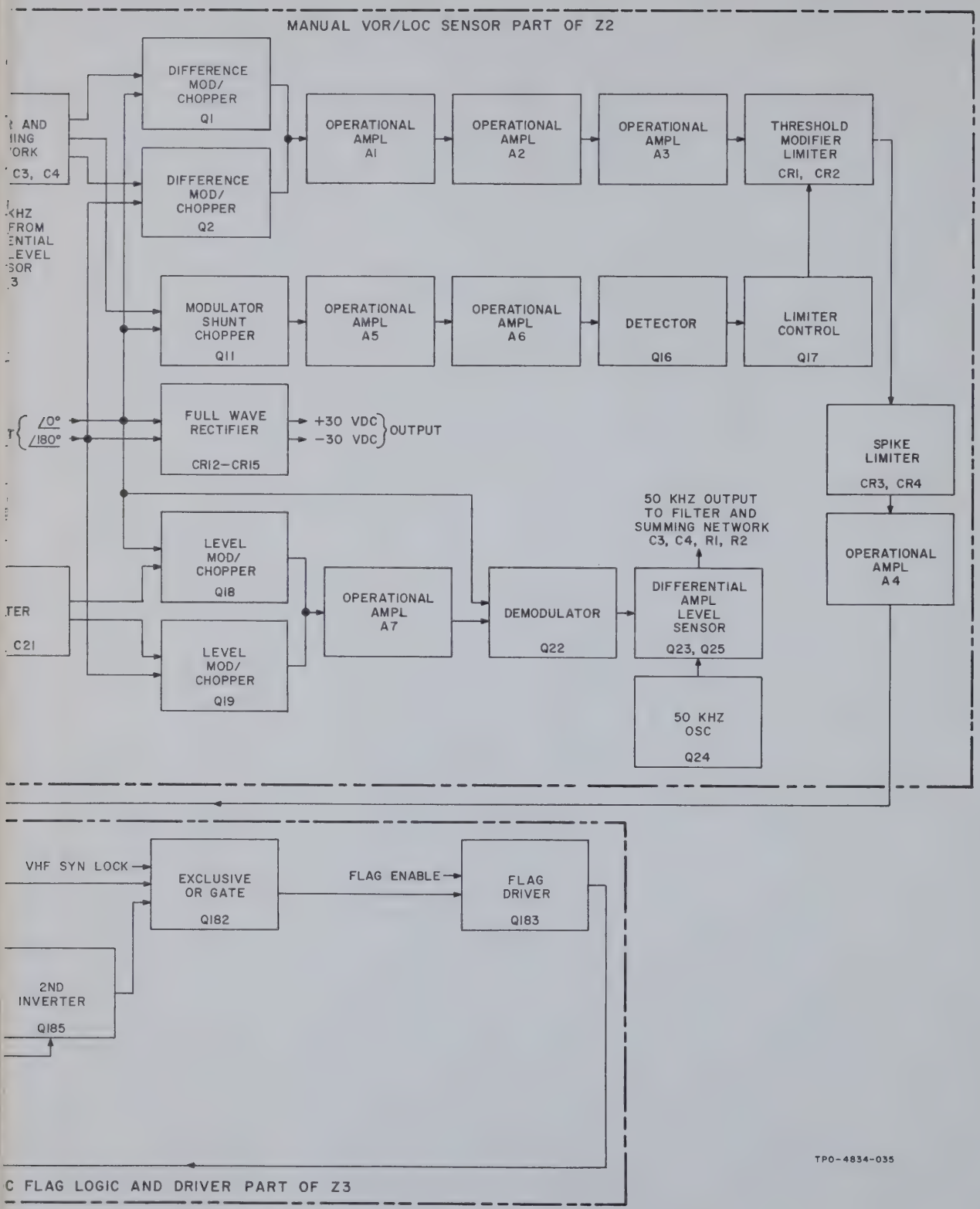
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 3 of 3)
Figure 15


Z3
SERVO AMPL Q72
SERVO TRANSFORMER T72
SERVO AMPL Q73
SERVO AMPL Q74
SERVO DRIVER Q75
SERVO DRIVER Q76
C79
C78
ARING MECHANISM CIRCUITY PART OF Z1
RATE
OC ILS
RMI 3 O'CLOCK BIAS CIRCUIT C301, C302, R301, CR303
DIFFERENTIAL SYNCHRO B4
RESOLVER B2
MOTOR-GENERATOR B1
MAGNETIC HEADING INPUT
VOR BEARING OUTPUT
COURSE RESOLVER STATORS
26 VAC 400 HZ
+27.5 VDC
BUFFER AMPL Q138
TIME DELAY SYNCHRONOUS FILTER C137, R153, R154
TIME DELAY SYNCHRONOUS FILTER SWITCH Q137
A
B

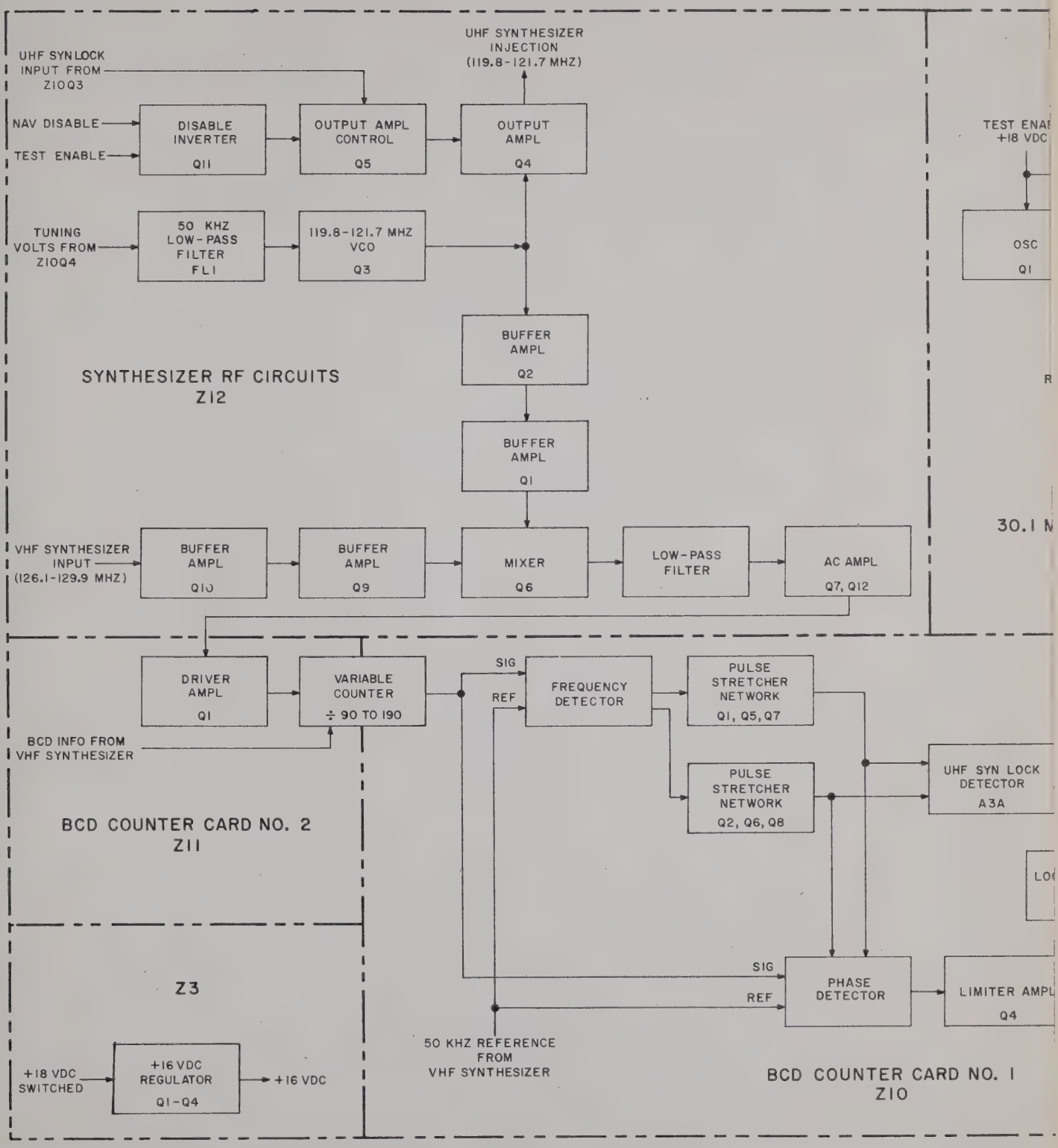
TPO-4834-035



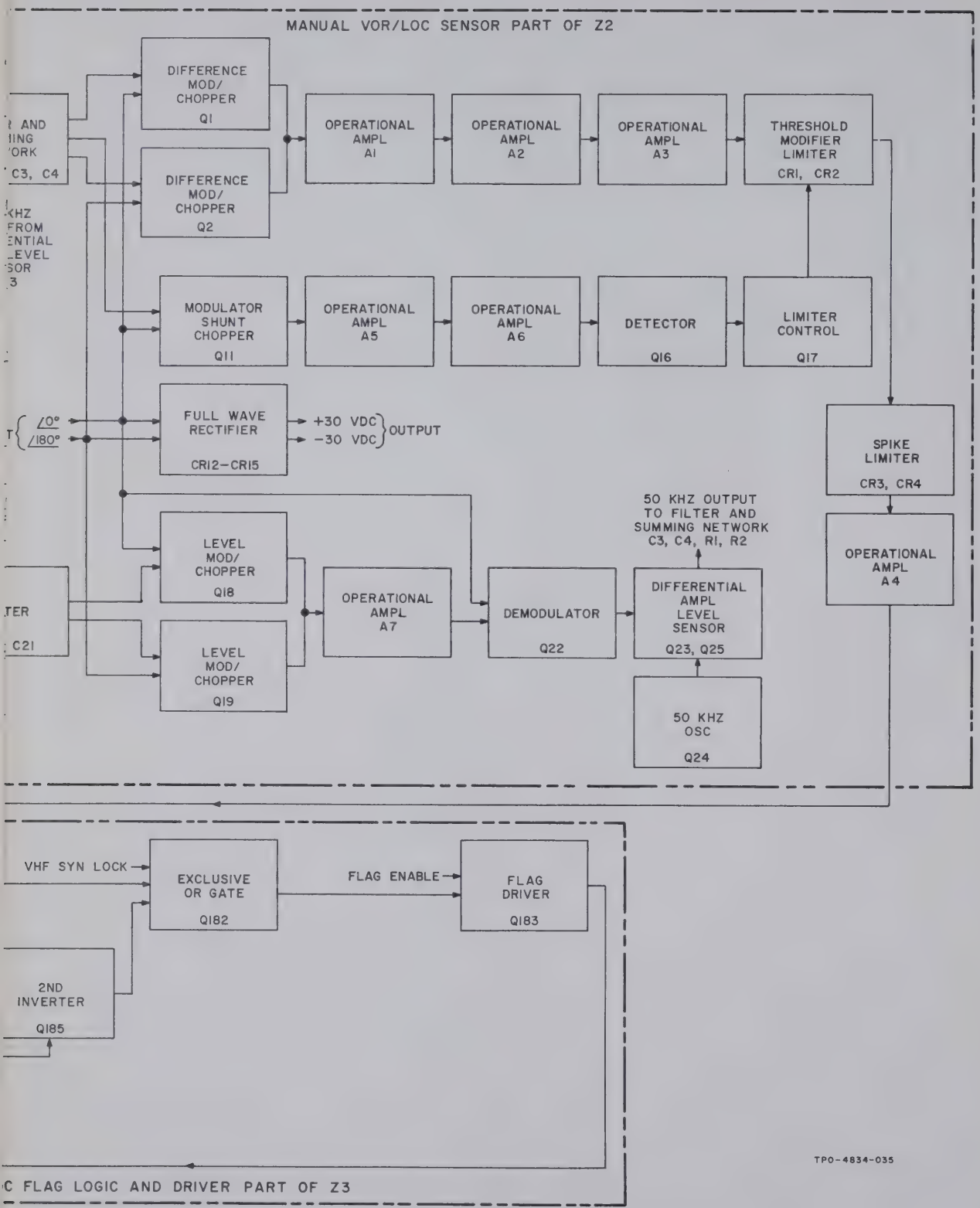
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 3 of 3)
Figure 15


MANUAL VOR/LOC SENSOR PART OF Z2
DIFFERENCE MOD/ CHOPPER Q1
DIFFERENCE MOD/ CHOPPER Q2
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
FULL WAVE RECTIFIER CR12–CR15
+30 VDC
−30 VDC
OUTPUT
SPIKE LIMITER CR3, CR4
OPERATIONAL AMPL A4
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
LEVEL MOD/ CHOPPER Q18
LEVEL MOD/ CHOPPER Q19
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OSC Q24
VHF SYN LOCK
EXCLUSIVE OR GATE Q182
FLAG ENABLE
FLAG DRIVER Q183
2ND INVERTER Q185
C FLAG LOGIC AND DRIVER PART OF Z3

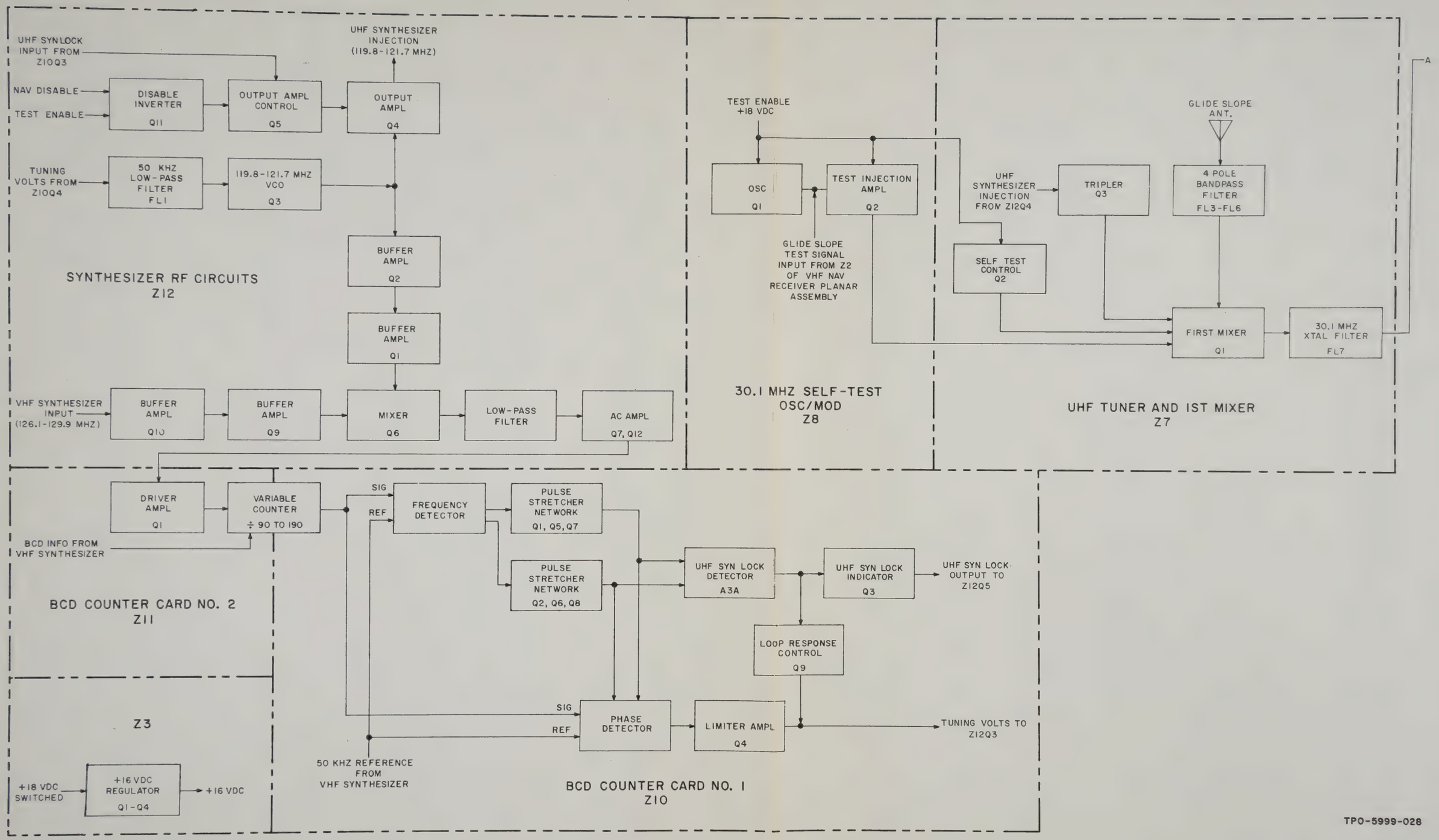
TPO-4834-035



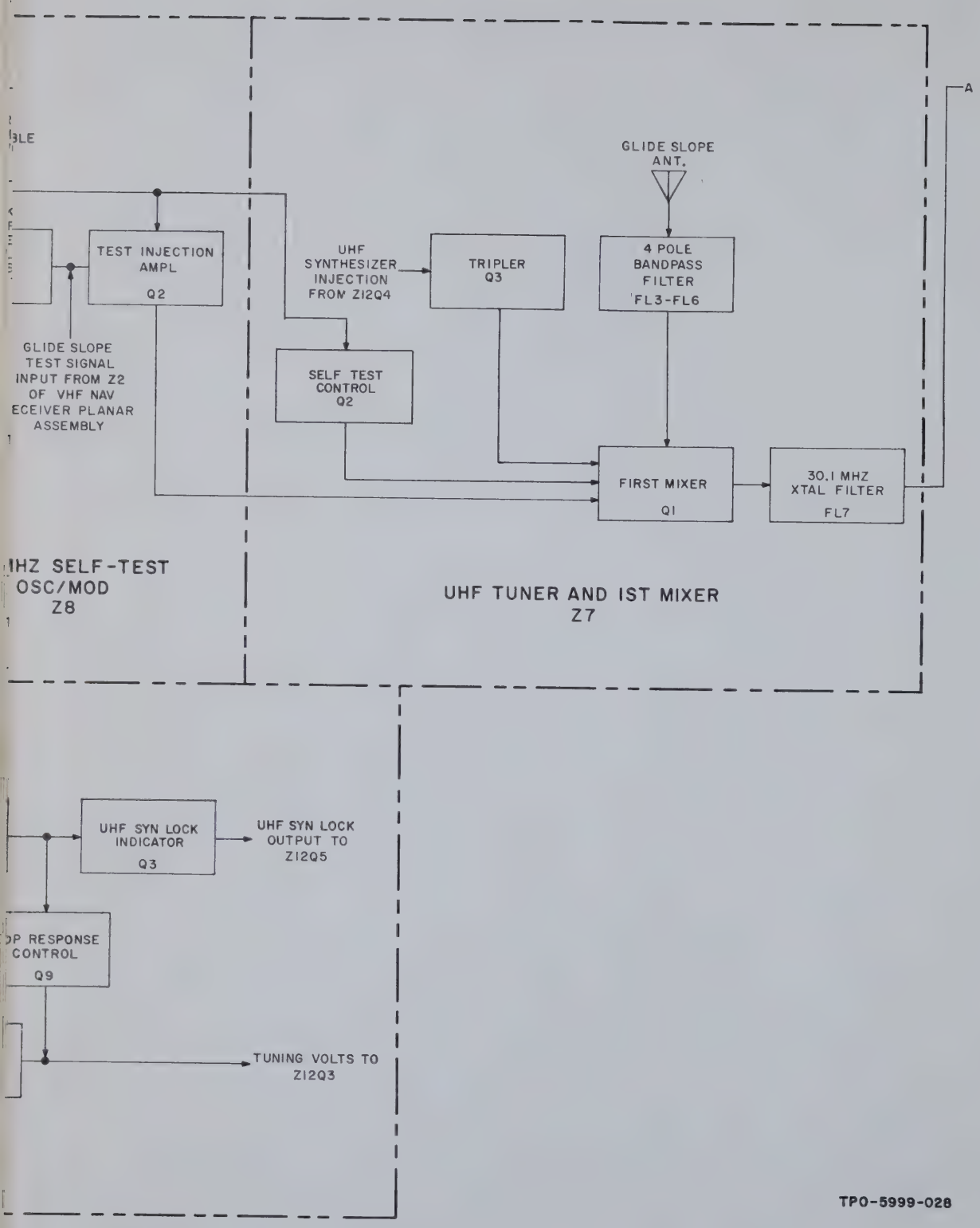
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 1 of 3)
Figure 16


MANUAL VOR/LOC SENSOR PART OF Z2
DIFFERENCE MOD/ CHOPPER Q1
DIFFERENCE MOD/ CHOPPER Q2
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
FULL WAVE RECTIFIER CR12–CR15
+30 VDC
−30 VDC
OUTPUT
SPIKE LIMITER CR3, CR4
OPERATIONAL AMPL A4
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
LEVEL MOD/ CHOPPER Q18
LEVEL MOD/ CHOPPER Q19
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OSC Q24
VHF SYN LOCK
EXCLUSIVE OR GATE Q182
FLAG ENABLE
FLAG DRIVER Q183
2ND INVERTER Q185
C FLAG LOGIC AND DRIVER PART OF Z3

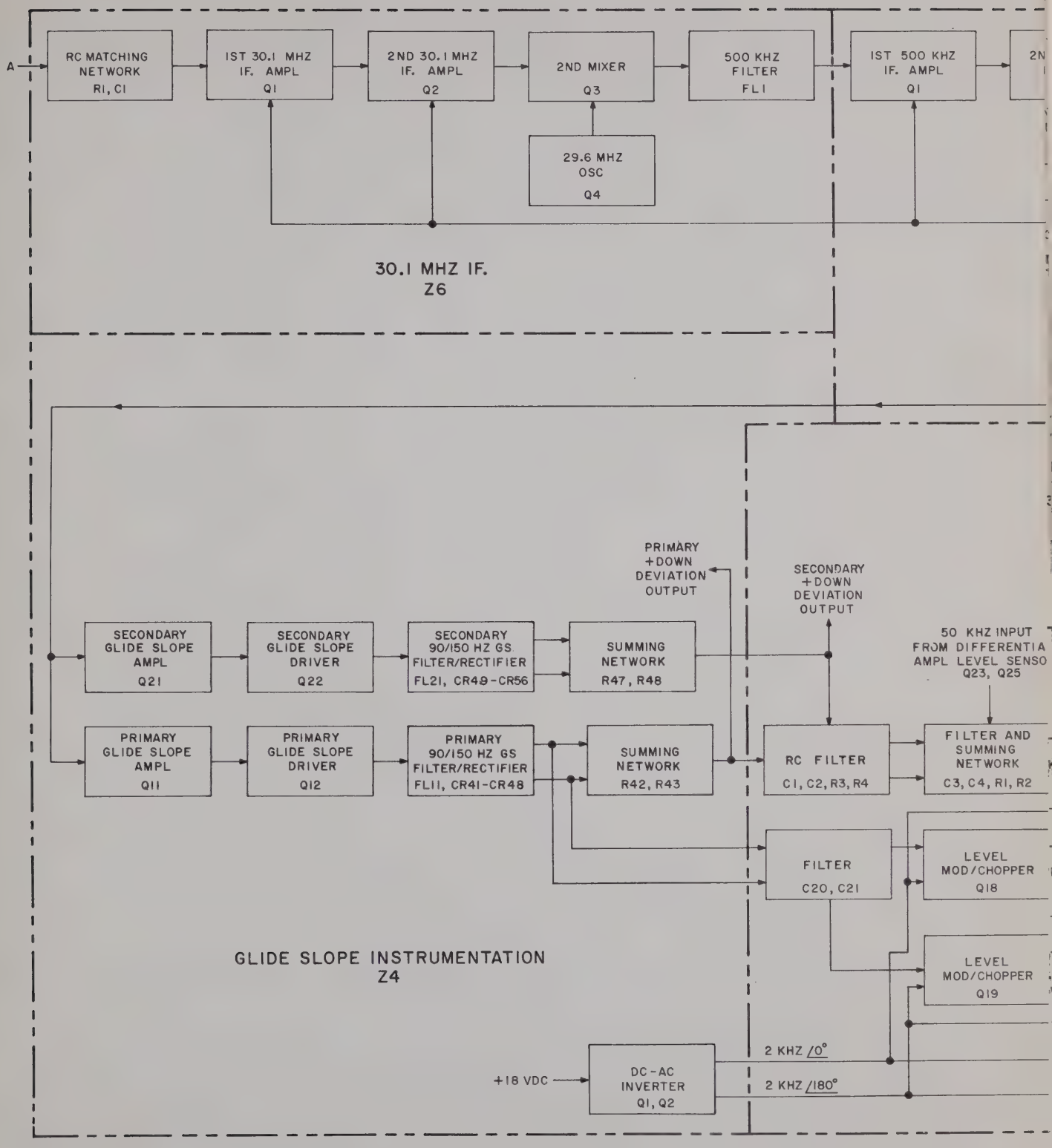
TPO-4834-035



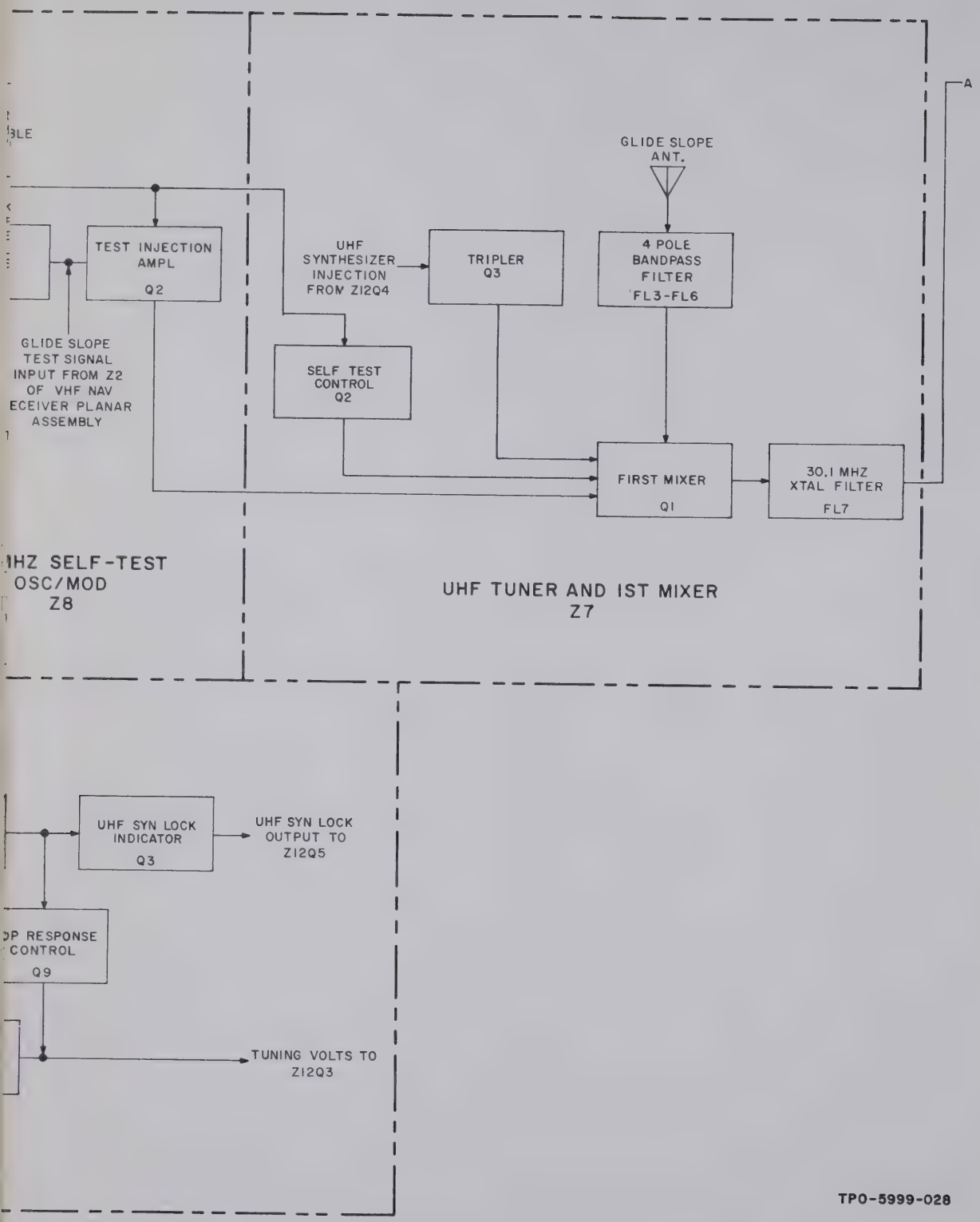
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 1 of 3)
Figure 16


A
GLIDE SLOPE ANT.
TEST INJECTION AMPL Q2
UHF SYNTHESIZER INJECTION FROM Z12Q4
TRIPLER Q3
4 POLE BANDPASS FILTER FL3-FL6
GLIDE SLOPE TEST SIGNAL INPUT FROM Z2 OF VHF NAV ECEIVER PLANAR ASSEMBLY
SELF TEST CONTROL Q2
FIRST MIXER Q1
30.1 MHZ XTAL FILTER FL7
UHF TUNER AND IST MIXER Z7
OSC/MOD Z8
UHF SYN LOCK INDICATOR Q3
UHF SYN LOCK OUTPUT TO Z12Q5
RESPONSE CONTROL Q9
TUNING VOLTS TO Z12Q3

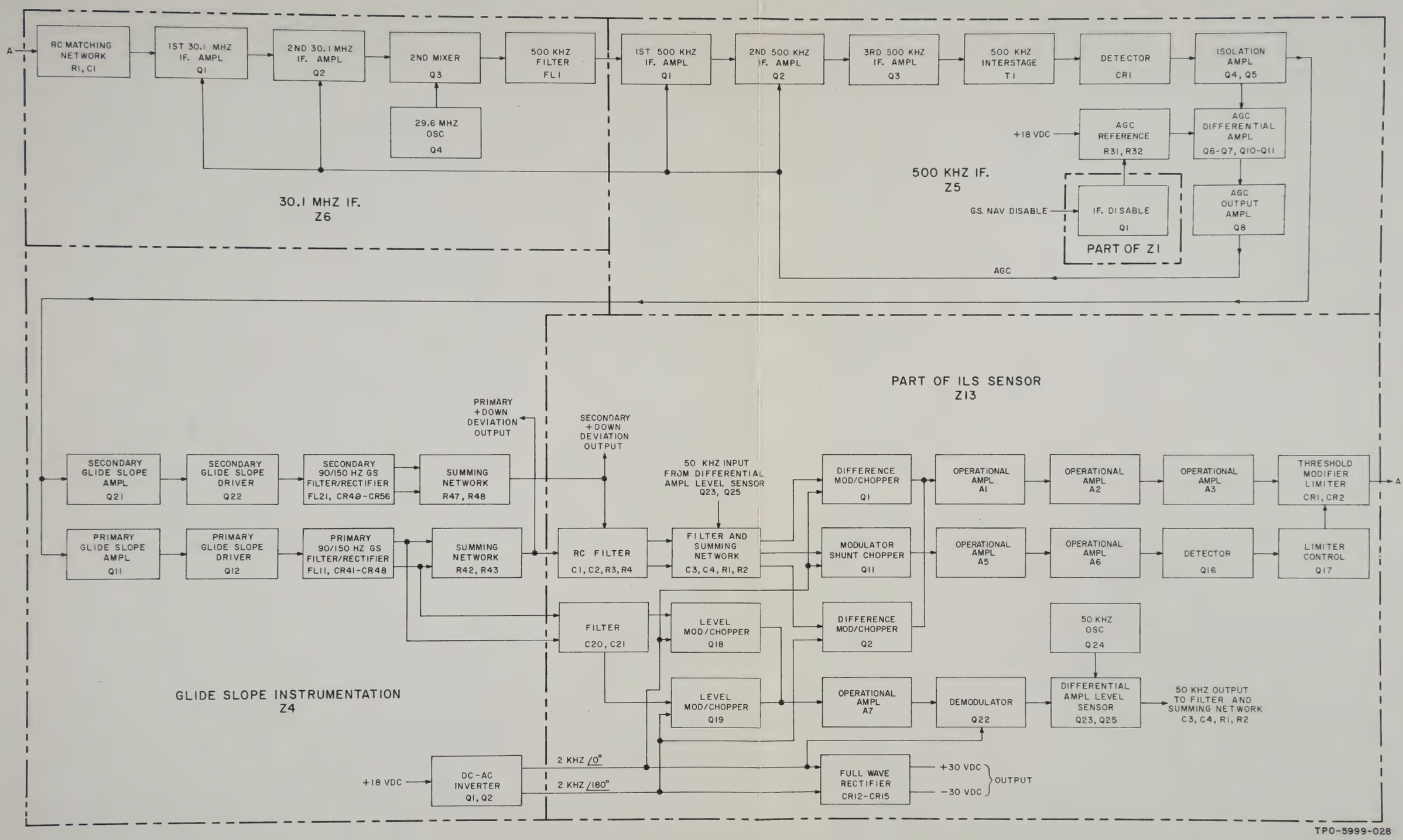
TPO-5999-028


A
RC MATCHING NETWORK R1, C1
1ST 30.1 MHZ IF. AMPL Q1
2ND 30.1 MHZ IF. AMPL Q2
2ND MIXER Q3
29.6 MHZ OSC Q4
500 KHZ FILTER FL1
1ST 500 KHZ IF. AMPL Q1
30.1 MHZ IF. Z6
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
50 KHZ INPUT FROM DIFFERENTIA AMPL LEVEL SENSO Q23, Q25
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°

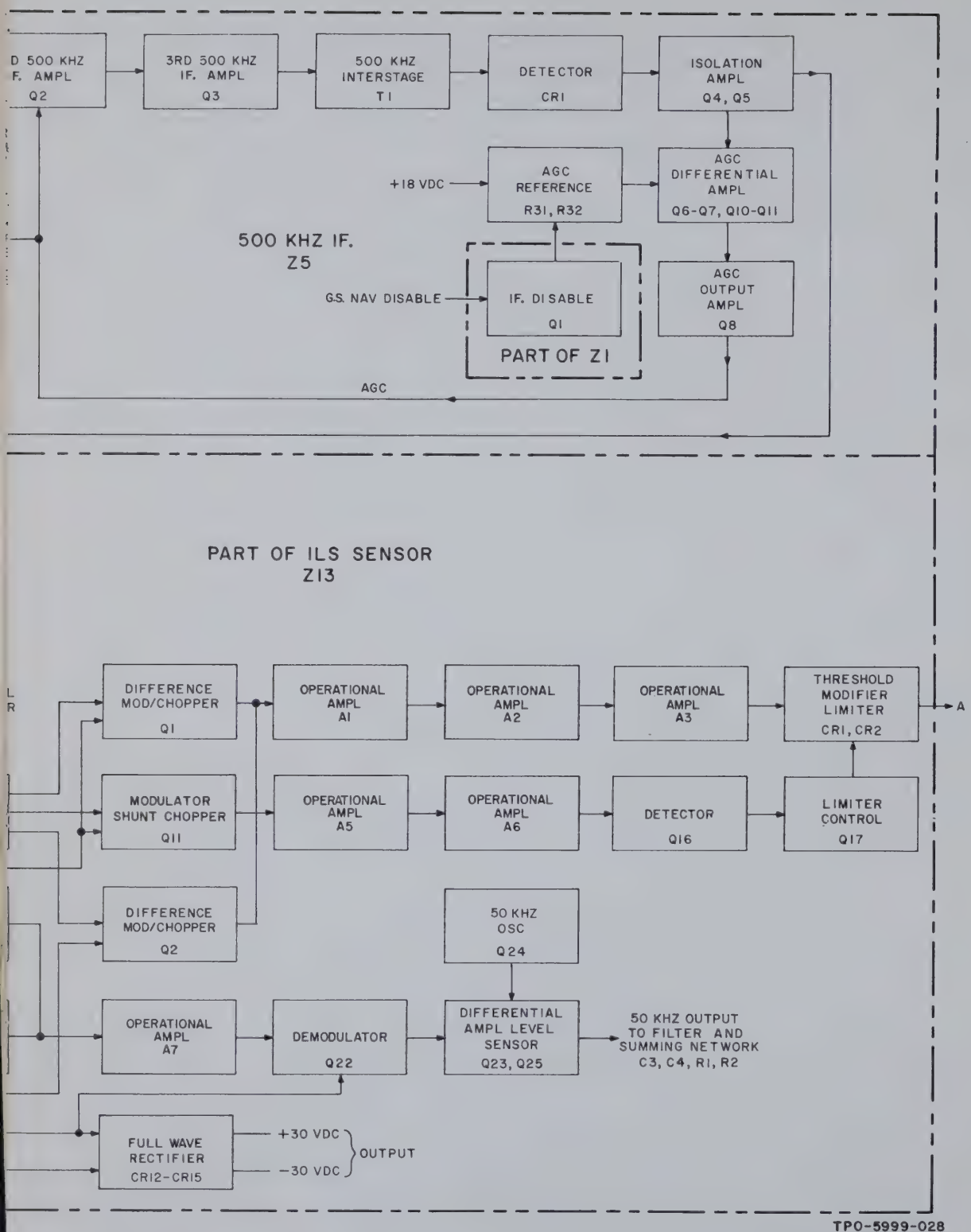
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 2 of 3)
Figure 16

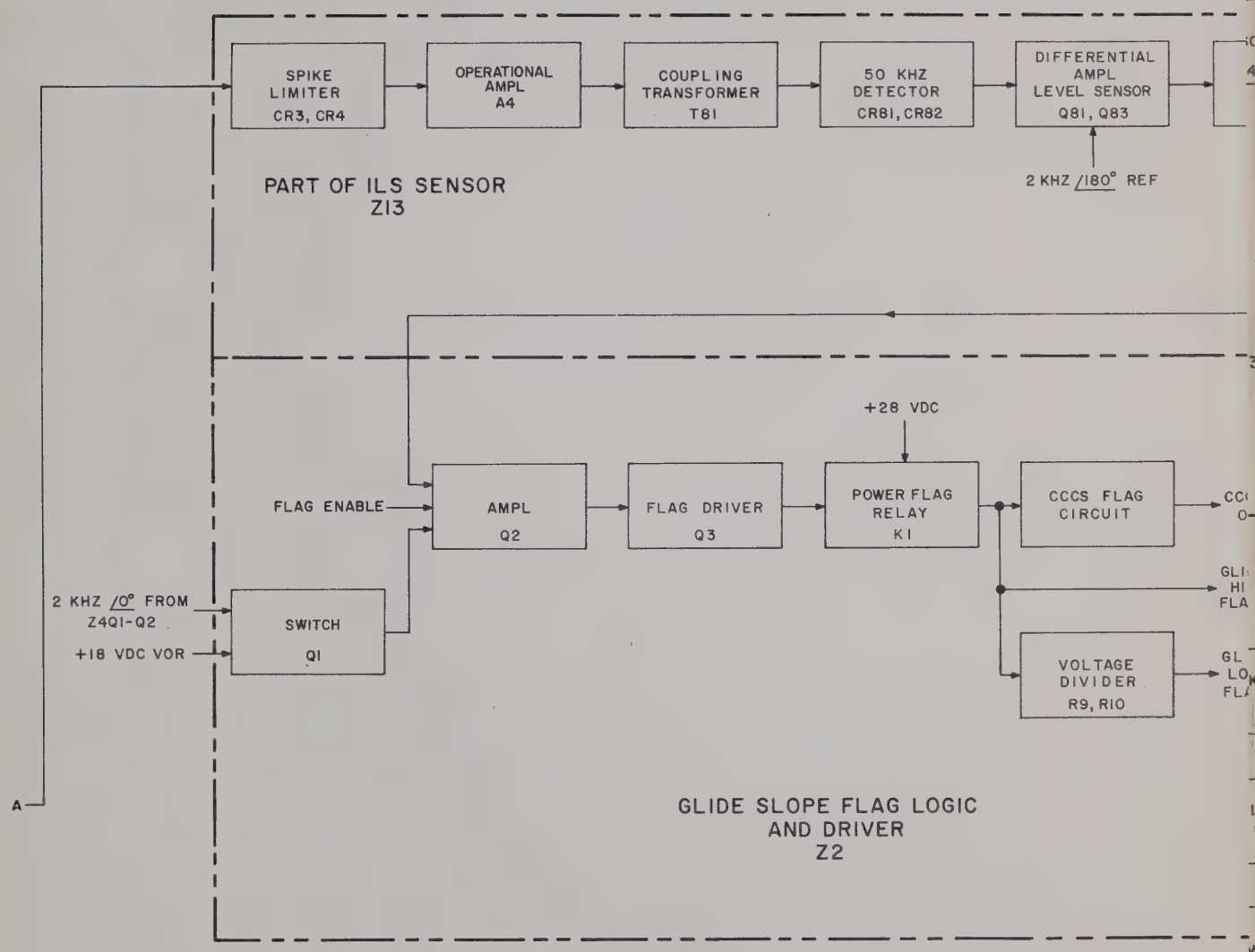

A
GLIDE SLOPE ANT.
TEST INJECTION AMPL Q2
UHF SYNTHESIZER INJECTION FROM Z12Q4
TRIPLER Q3
4 POLE BANDPASS FILTER FL3-FL6
GLIDE SLOPE TEST SIGNAL INPUT FROM Z2 OF VHF NAV ECEIVER PLANAR ASSEMBLY
SELF TEST CONTROL Q2
FIRST MIXER Q1
30.1 MHZ XTAL FILTER FL7
UHF TUNER AND IST MIXER Z7
UHF SYN LOCK INDICATOR Q3
UHF SYN LOCK OUTPUT TO Z12Q5
CONTROL Q9
TUNING VOLTS TO Z12Q3

TPO-5999-028

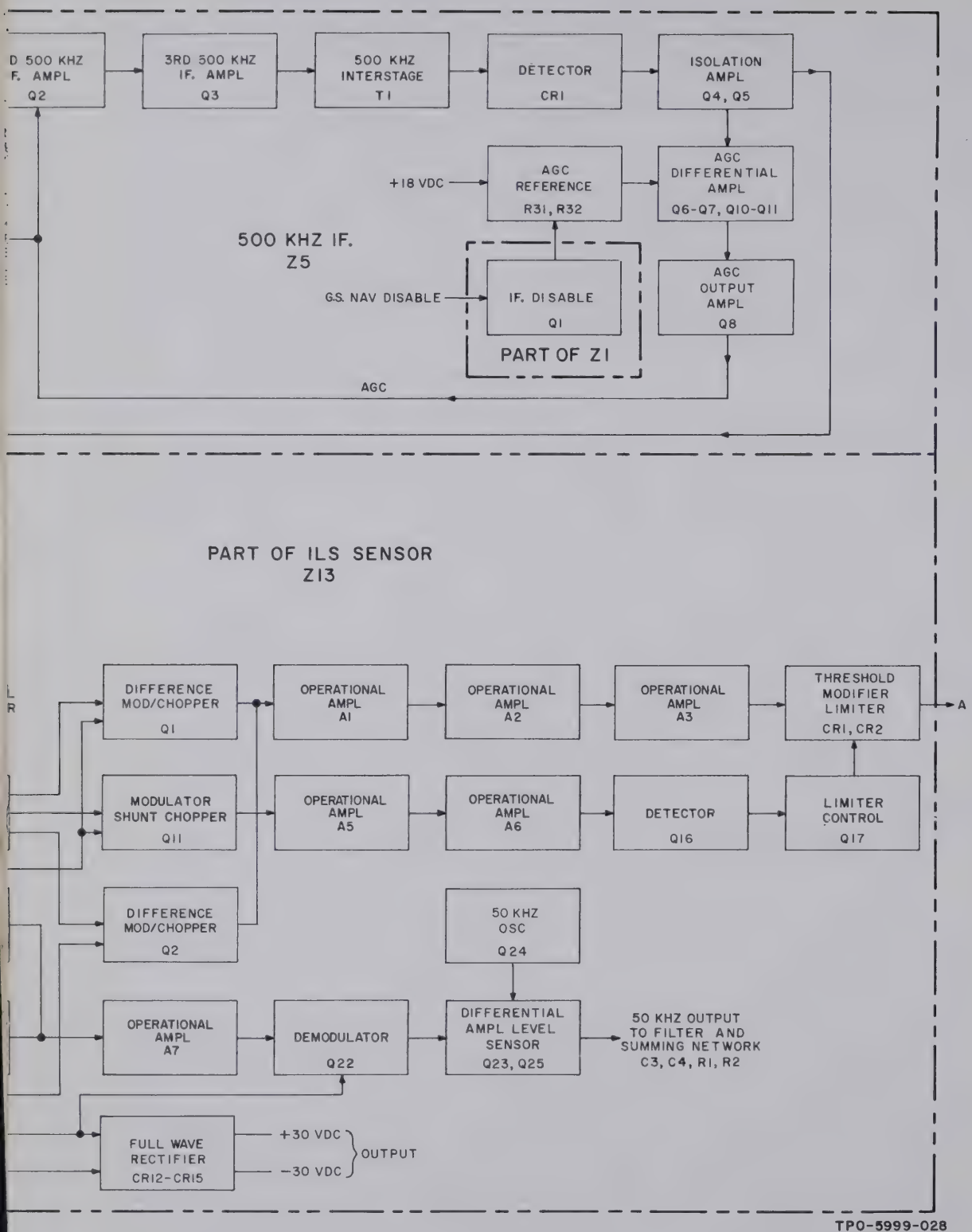

A
RC MATCHING NETWORK R1, C1
1ST 30.1 MHZ IF. AMPL Q1
2ND 30.1 MHZ IF. AMPL Q2
2ND MIXER Q3
29.6 MHZ OSC Q4
500 KHZ FILTER FL1
30.1 MHZ IF. Z6
1ST 500 KHZ IF. AMPL Q1
2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
PART OF Z1
AGC OUTPUT AMPL Q8
AGC
PART OF ILS SENSOR Z13
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
50 KHZ INPUT FROM DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
DIFFERENCE MOD/CHOPPER Q1
MODULATOR SHUNT CHOPPER Q11
DIFFERENCE MOD/CHOPPER Q2
OPERATIONAL AMPL A7
DEMODULATOR Q22
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
THRESHOLD MODIFIER LIMITER CR1, CR2
LIMITER CONTROL Q17
50 KHZ OSC Q24
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TPO-5999-028

Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 2 of 3)
Figure 16


D 500 KHZ
F. AMPL
Q2
3RD 500 KHZ
IF. AMPL
Q3
500 KHZ
INTERSTAGE
T1
DETECTOR
CR1
ISOLATION
AMPL
Q4, Q5
+18 VDC
AGC
REFERENCE
R31, R32
AGC
DIFFERENTIAL
AMPL
Q6-Q7, Q10-Q11
500 KHZ IF.
Z5
G.S. NAV DISABLE
IF. DISABLE
Q1
PART OF Z1
AGC
OUTPUT
AMPL
Q8
AGC
PART OF ILS SENSOR
Z13
DIFFERENCE
MOD/CHOPPER
Q1
OPERATIONAL
AMPL
A1
OPERATIONAL
AMPL
A2
OPERATIONAL
AMPL
A3
THRESHOLD
MODIFIER
LIMITER
CR1, CR2
A
MODULATOR
SHUNT CHOPPER
Q11
OPERATIONAL
AMPL
A5
OPERATIONAL
AMPL
A6
DETECTOR
Q16
LIMITER
CONTROL
Q17
DIFFERENCE
MOD/CHOPPER
Q2
50 KHZ
OSC
Q24
OPERATIONAL
AMPL
A7
DEMODULATOR
Q22
DIFFERENTIAL
AMPL LEVEL
SENSOR
Q23, Q25
50 KHZ OUTPUT
TO FILTER AND
SUMMING NETWORK
C3, C4, R1, R2
FULL WAVE
RECTIFIER
CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TP0-5999-028

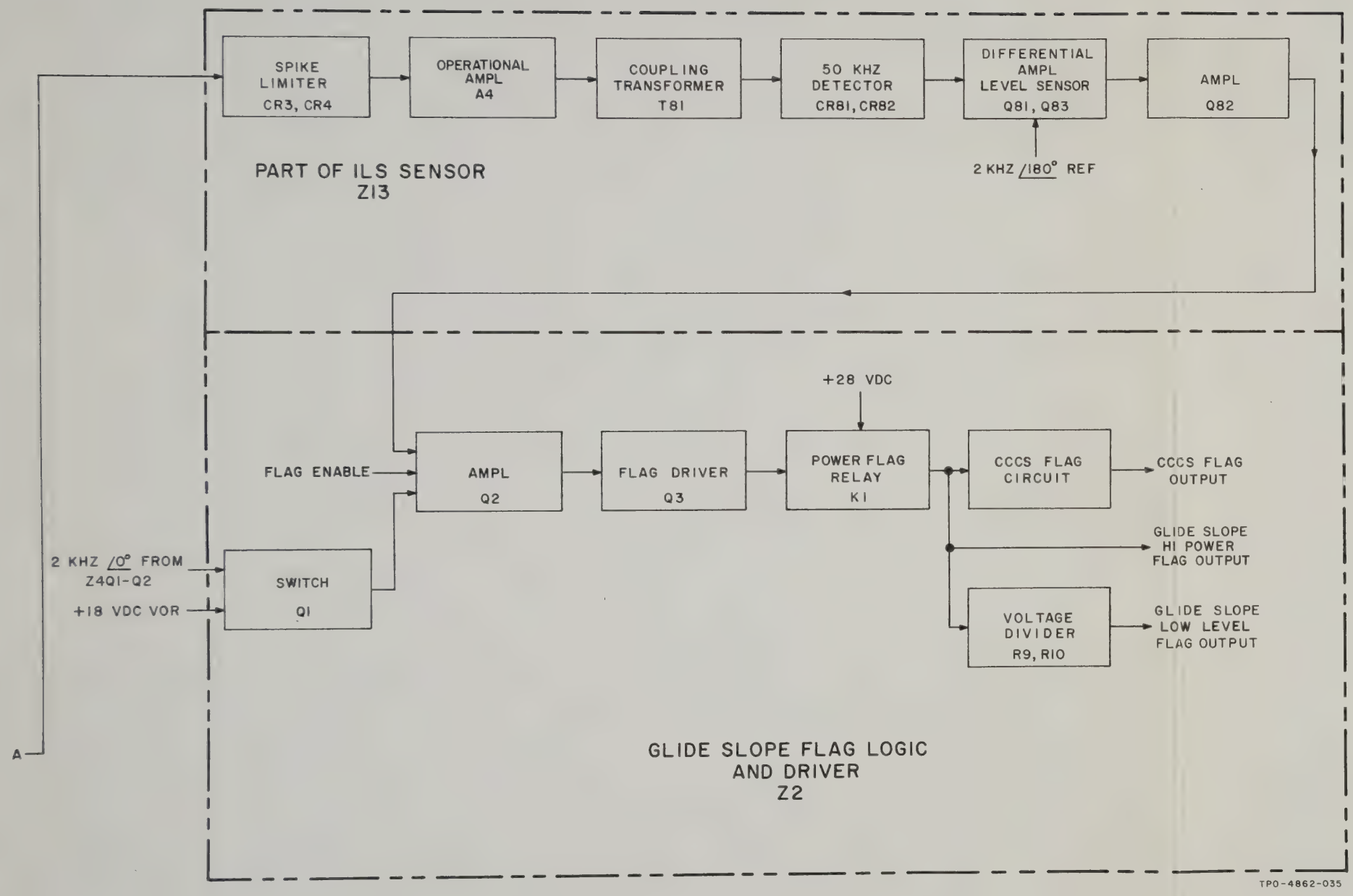


Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 3 of 3)
Figure 16

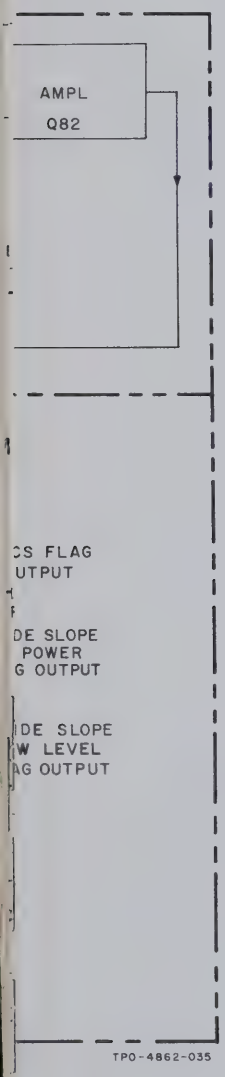


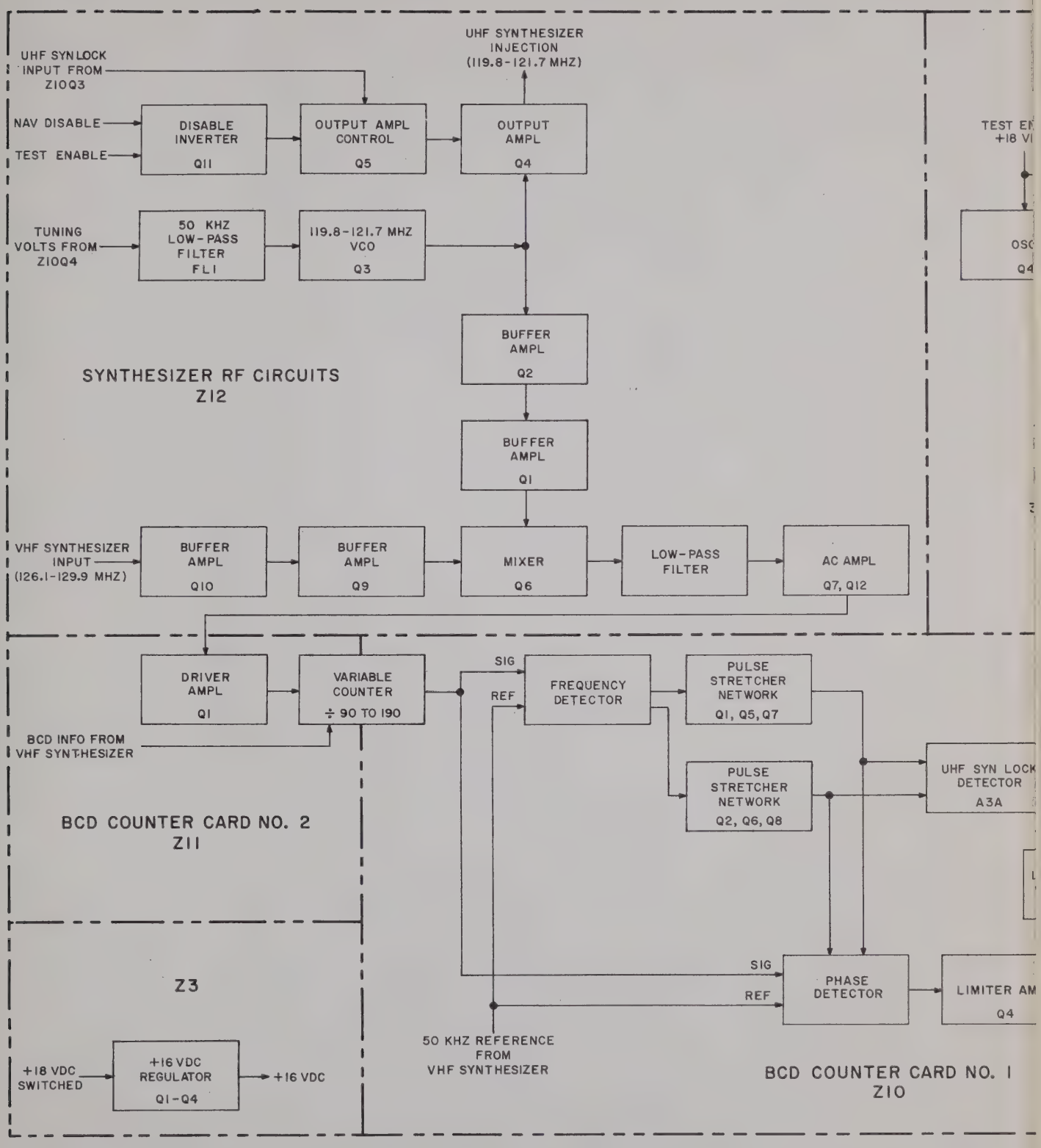
PART OF ILS SENSOR
Z13

TPO-5999-028

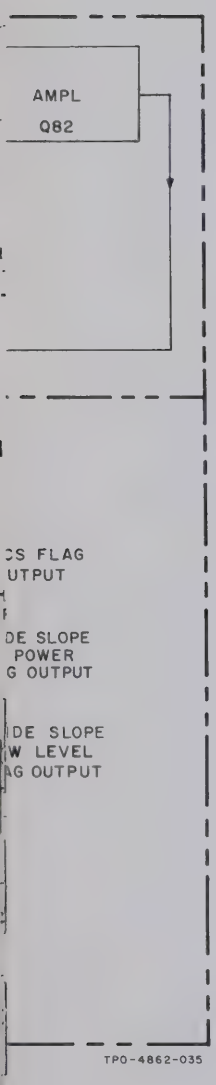


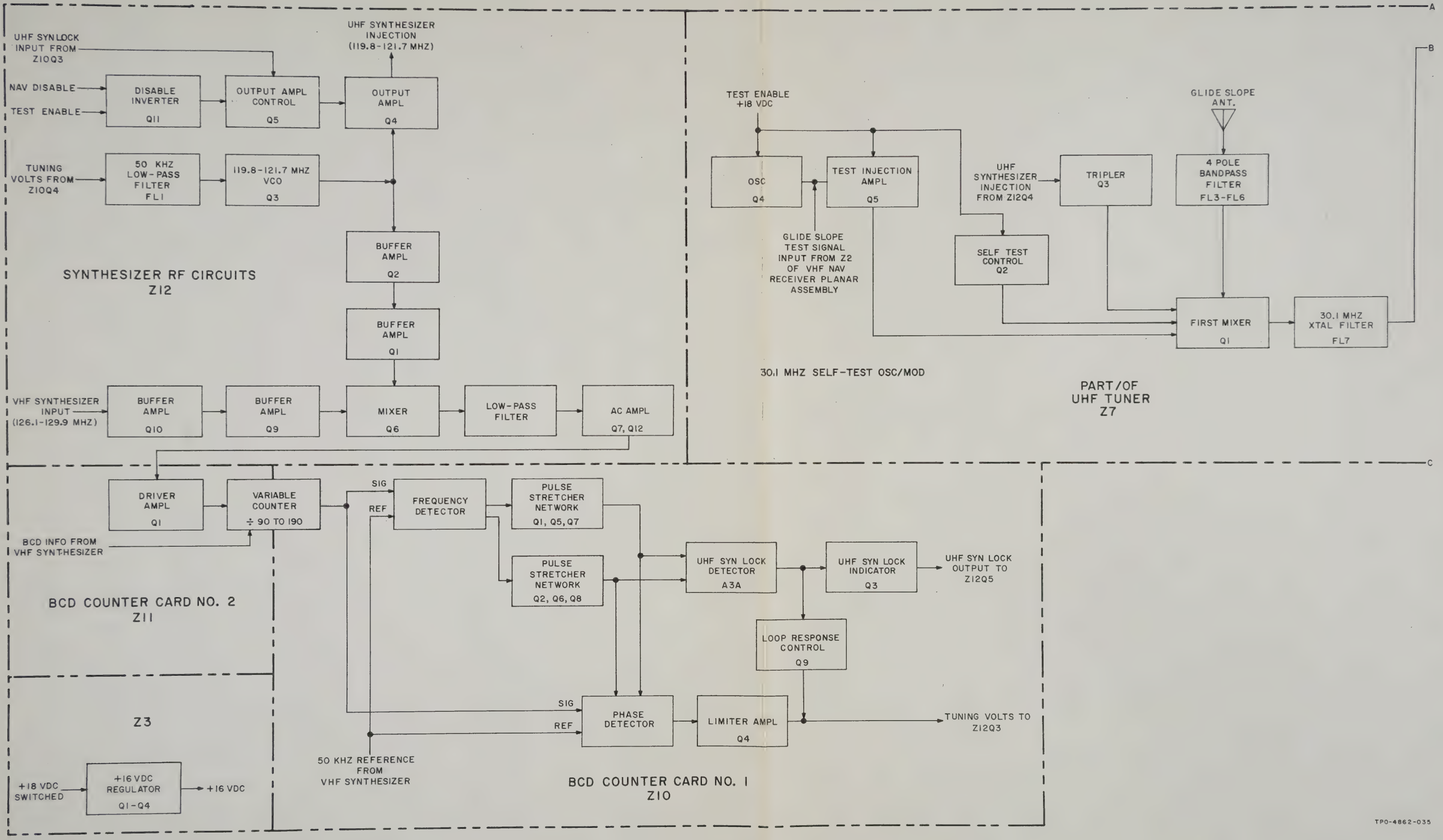
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without 1-Piece UHF Front End Casting (Sheet 3 of 3)
Figure 16


AMPL
Q82
CS FLAG
UTPUT
DE SLOPE
POWER
G OUTPUT
IDE SLOPE
W LEVEL
AG OUTPUT
TPO-4862-035

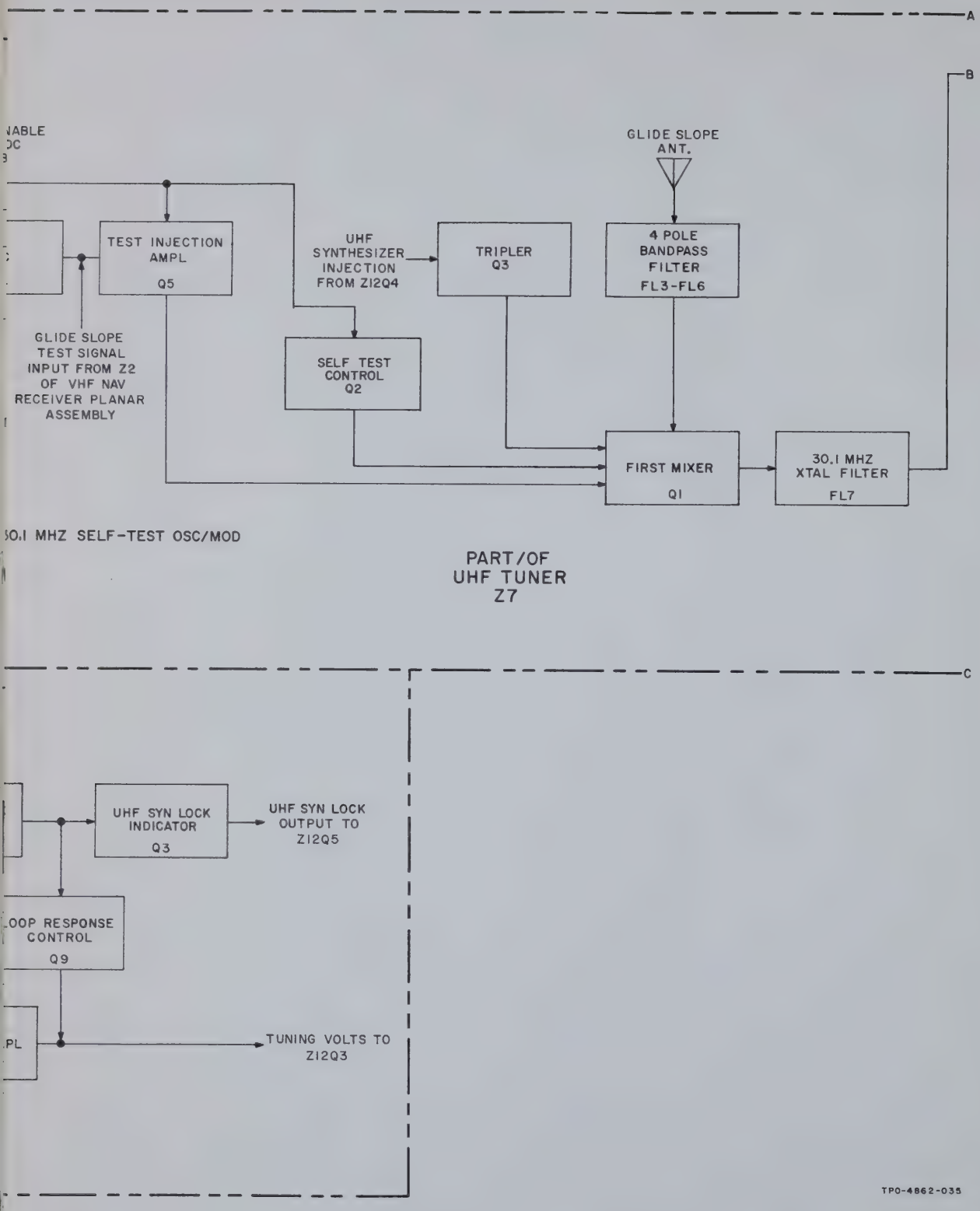


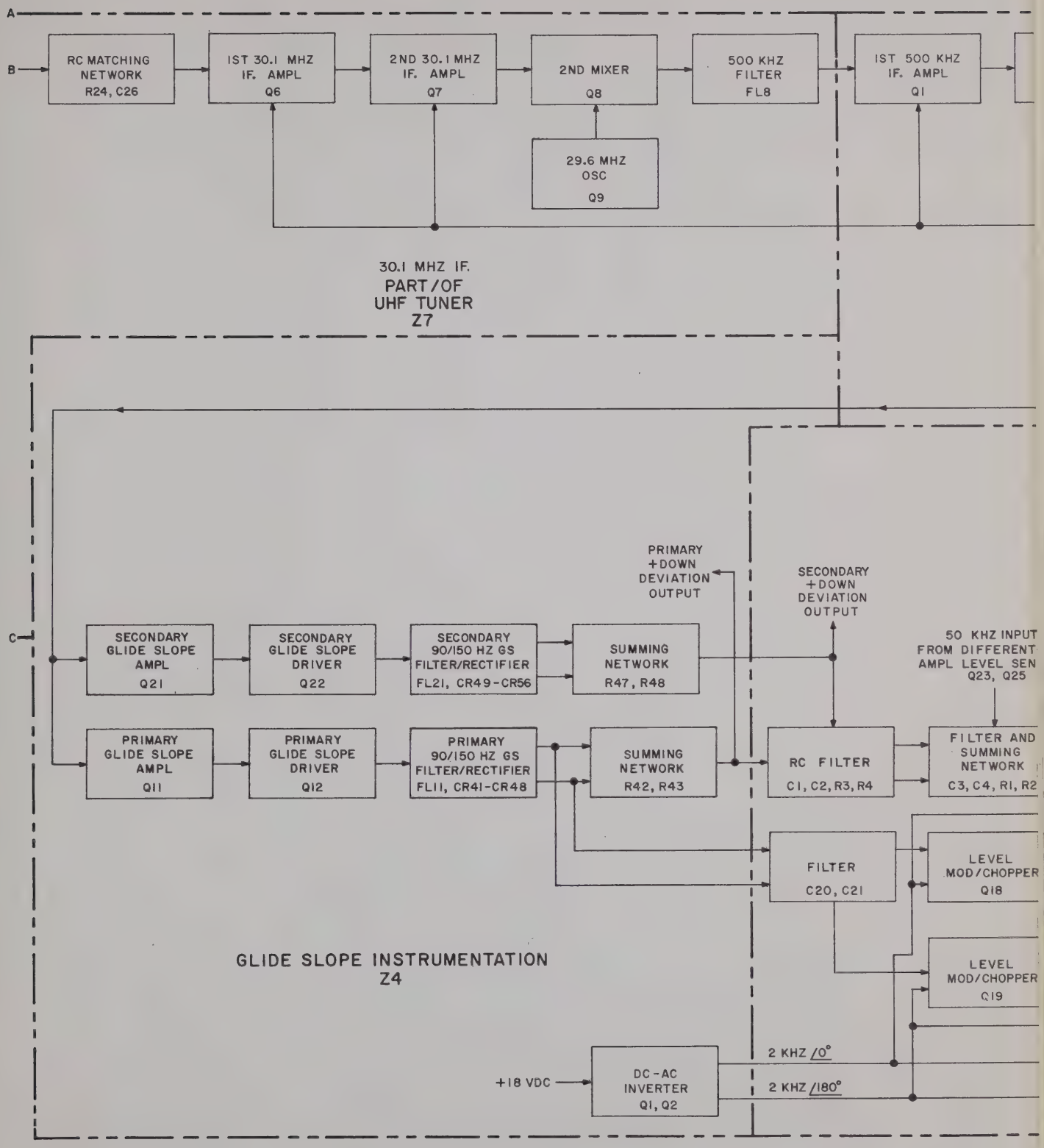
Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 1 of 3)
Figure 17


AMPL
Q82
CS FLAG
UTPUT
DE SLOPE
POWER
G OUTPUT
DE SLOPE
W LEVEL
AG OUTPUT
TP0-4862-035

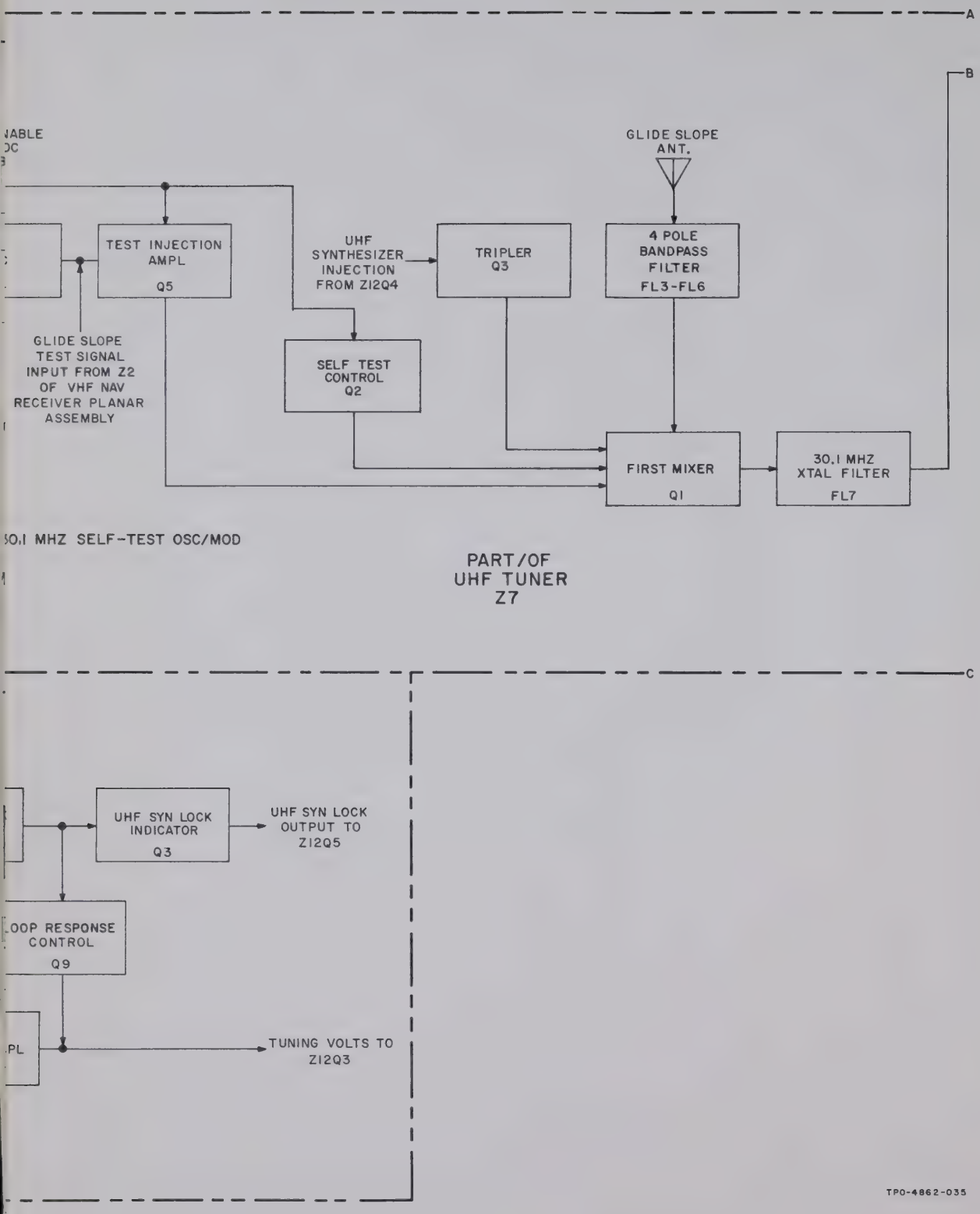


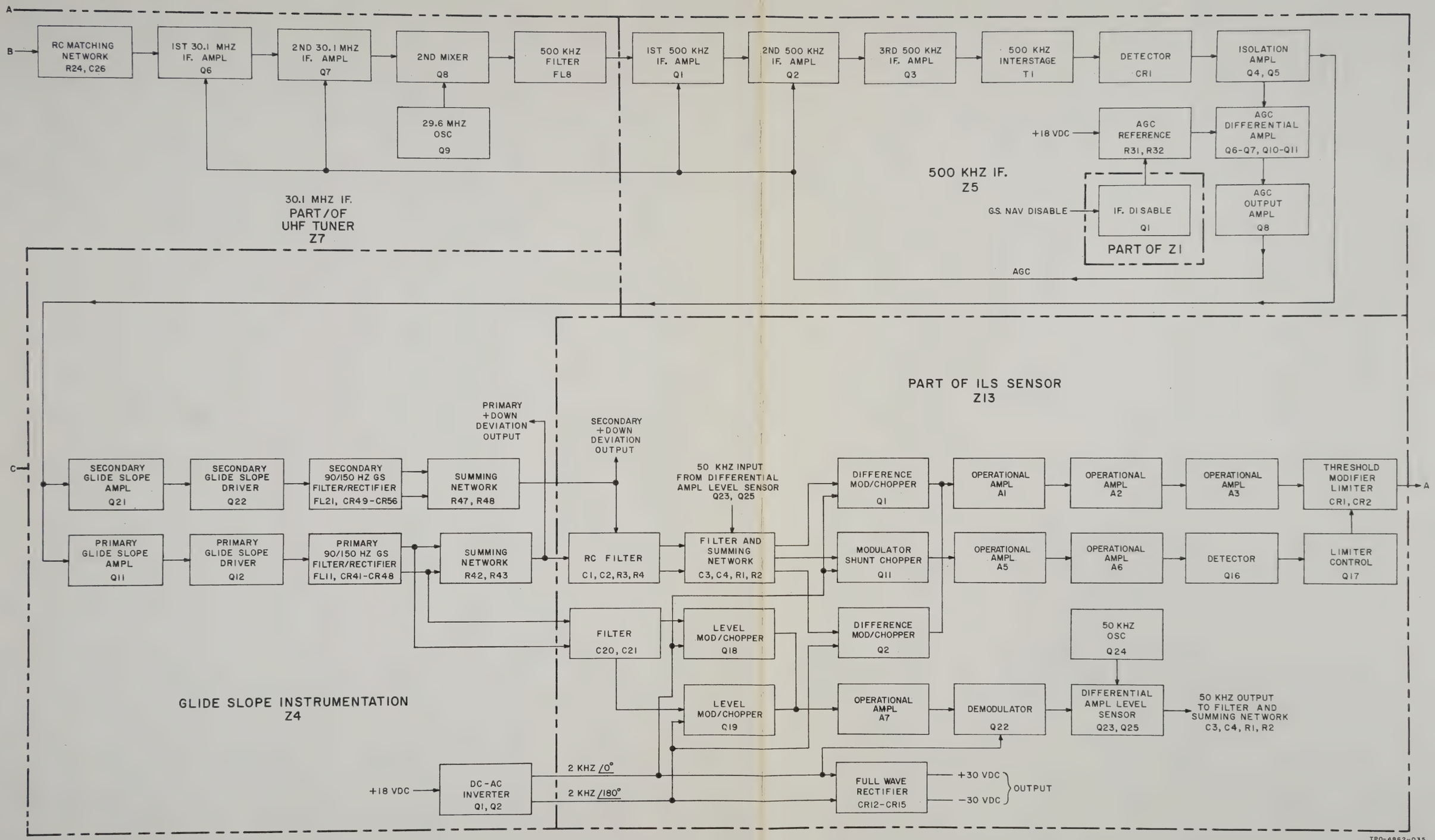
Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 1 of 3)
Figure 17


A
B
C
NABLE
OC
TEST INJECTION AMPL
Q5
GLIDE SLOPE TEST SIGNAL INPUT FROM Z2 OF VHF NAV RECEIVER PLANAR ASSEMBLY
UHF SYNTHESIZER INJECTION FROM Z12Q4
TRIPLER
Q3
GLIDE SLOPE ANT.
4 POLE BANDPASS FILTER
FL3-FL6
SELF TEST CONTROL
Q2
FIRST MIXER
Q1
30.1 MHZ XTAL FILTER
FL7
30.1 MHZ SELF-TEST OSC/MOD
PART OF
UHF TUNER
Z7
UHF SYN LOCK INDICATOR
Q3
UHF SYN LOCK OUTPUT TO Z12Q5
OOP RESPONSE CONTROL
Q9
PL
TUNING VOLTS TO Z12Q3
TP0-4862-035

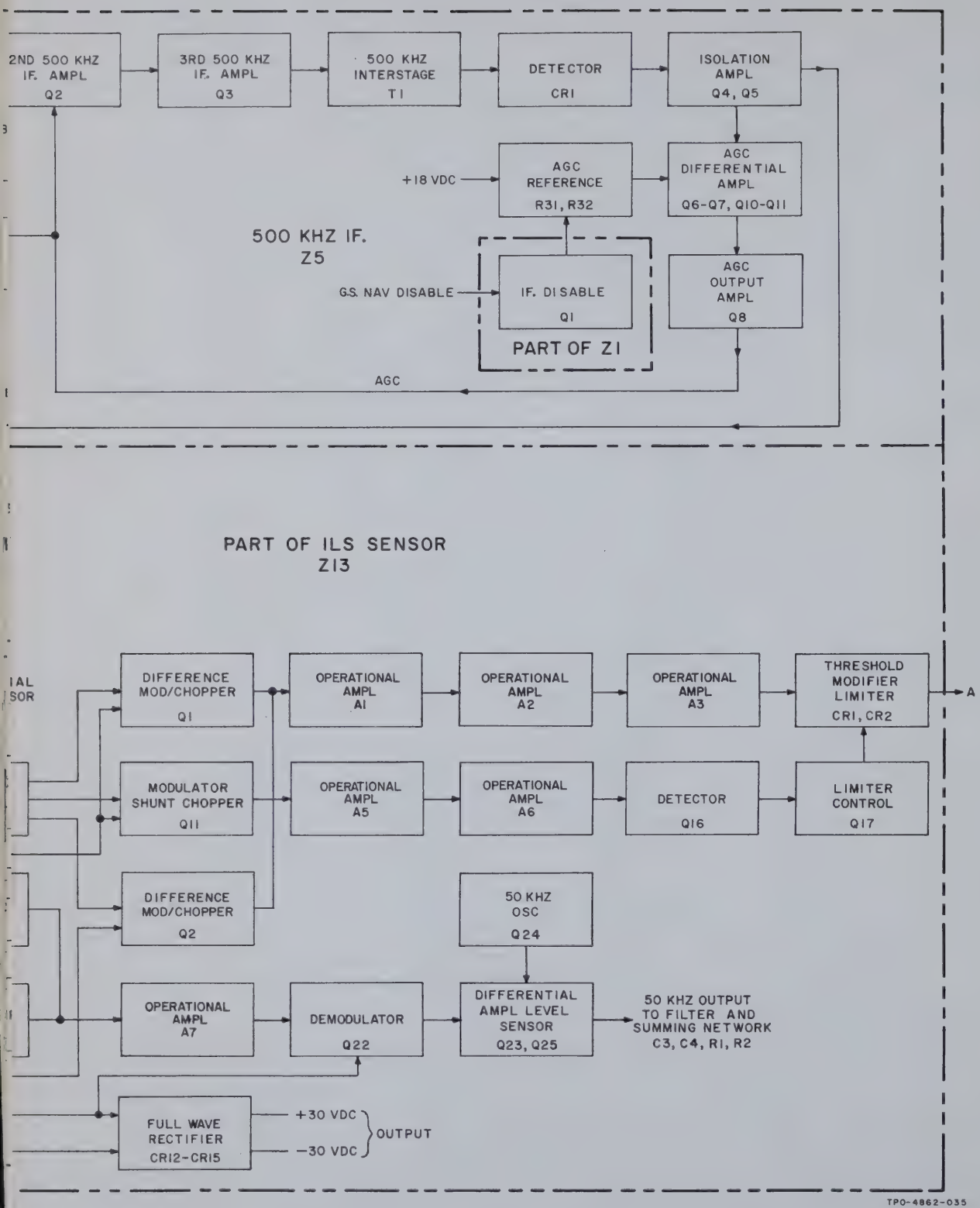

A
B
RC MATCHING NETWORK R24, C26
1ST 30.1 MHZ IF. AMPL Q6
2ND 30.1 MHZ IF. AMPL Q7
2ND MIXER Q8
29.6 MHZ OSC Q9
500 KHZ FILTER FL8
1ST 500 KHZ IF. AMPL Q1
30.1 MHZ IF. PART OF UHF TUNER Z7
C
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
50 KHZ INPUT FROM DIFFERENT AMPL LEVEL SEN Q23, Q25
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°

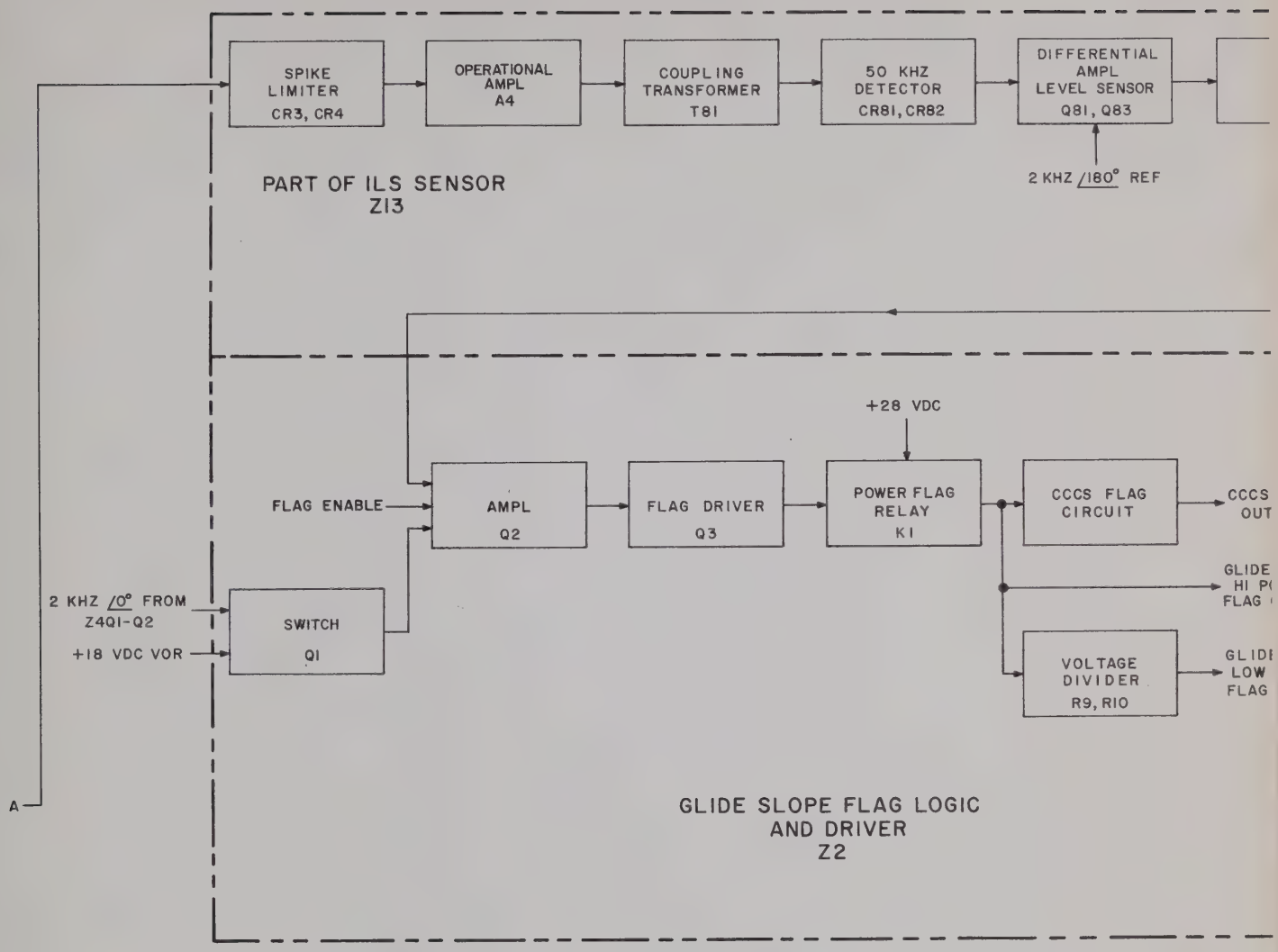
Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 2 of 3)
Figure 17


A
B
GLIDE SLOPE ANT.
TEST INJECTION AMPL Q5
UHF SYNTHESIZER INJECTION FROM Z12Q4
TRIPLER Q3
4 POLE BANDPASS FILTER FL3-FL6
GLIDE SLOPE TEST SIGNAL INPUT FROM Z2 OF VHF NAV RECEIVER PLANAR ASSEMBLY
SELF TEST CONTROL Q2
FIRST MIXER Q1
30.1 MHZ XTAL FILTER FL7
PART OF UHF TUNER Z7
C
UHF SYN LOCK INDICATOR Q3
UHF SYN LOCK OUTPUT TO Z12Q5
Q9
TUNING VOLTS TO Z12Q3
TP0-4862-035

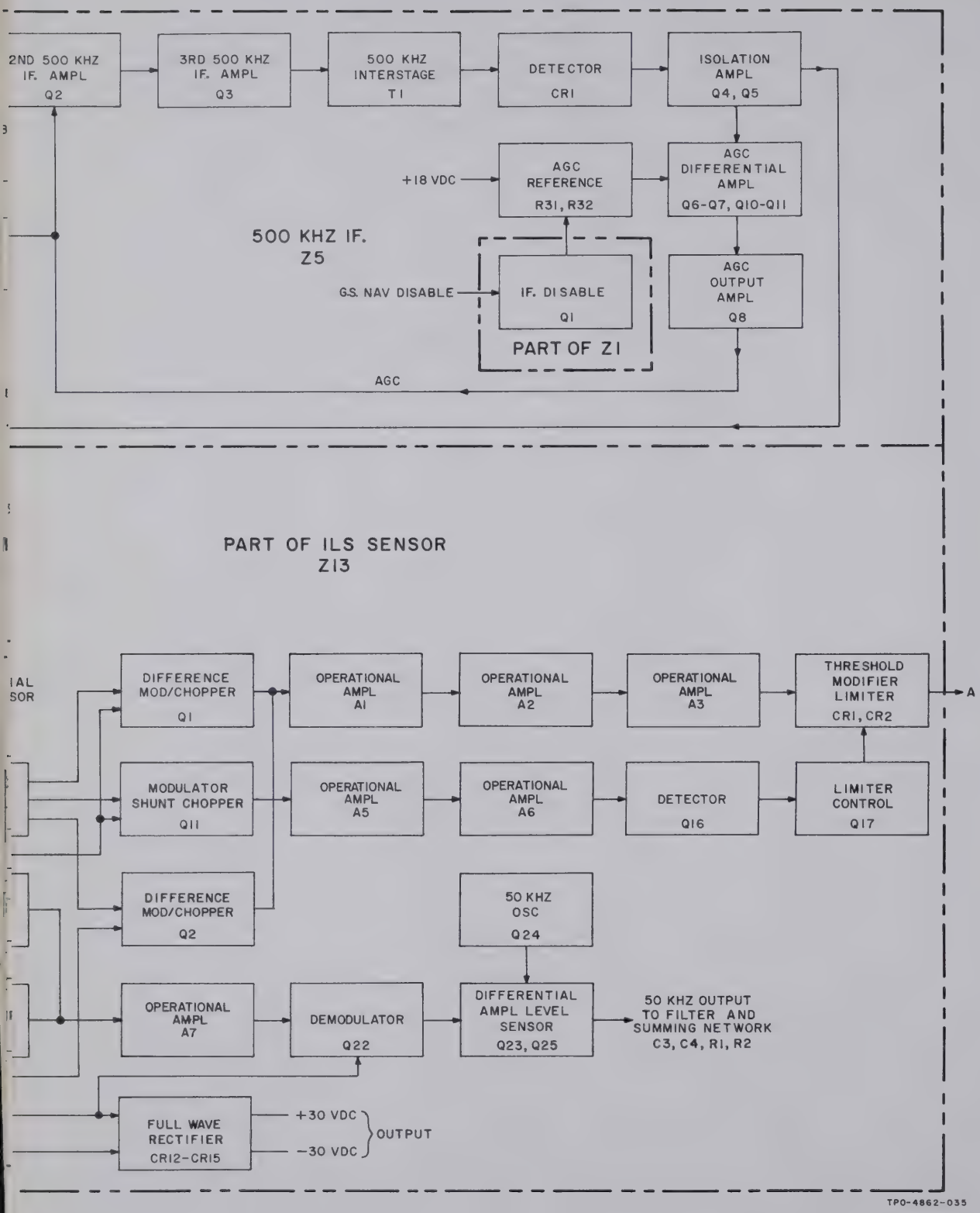

A
B
RC MATCHING NETWORK R24, C26
1ST 30.1 MHZ IF. AMPL Q6
2ND 30.1 MHZ IF. AMPL Q7
2ND MIXER Q8
29.6 MHZ OSC Q9
500 KHZ FILTER FL8
1ST 500 KHZ IF. AMPL Q1
2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
PART OF Z1
AGC OUTPUT AMPL Q8
AGC
30.1 MHZ IF. PART OF UHF TUNER Z7
PART OF ILS SENSOR Z13
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
50 KHZ INPUT FROM DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
C
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
DIFFERENCE MOD/CHOPPER Q1
MODULATOR SHUNT CHOPPER Q11
DIFFERENCE MOD/CHOPPER Q2
OPERATIONAL AMPL A7
DEMODULATOR Q22
OPERATIONAL AMPL A1
OPERATIONAL AMPL A5
OPERATIONAL AMPL A2
OPERATIONAL AMPL A6
OPERATIONAL AMPL A3
DETECTOR Q16
THRESHOLD MODIFIER LIMITER CR1, CR2
LIMITER CONTROL Q17
50 KHZ OSC Q24
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TP0-4862-035

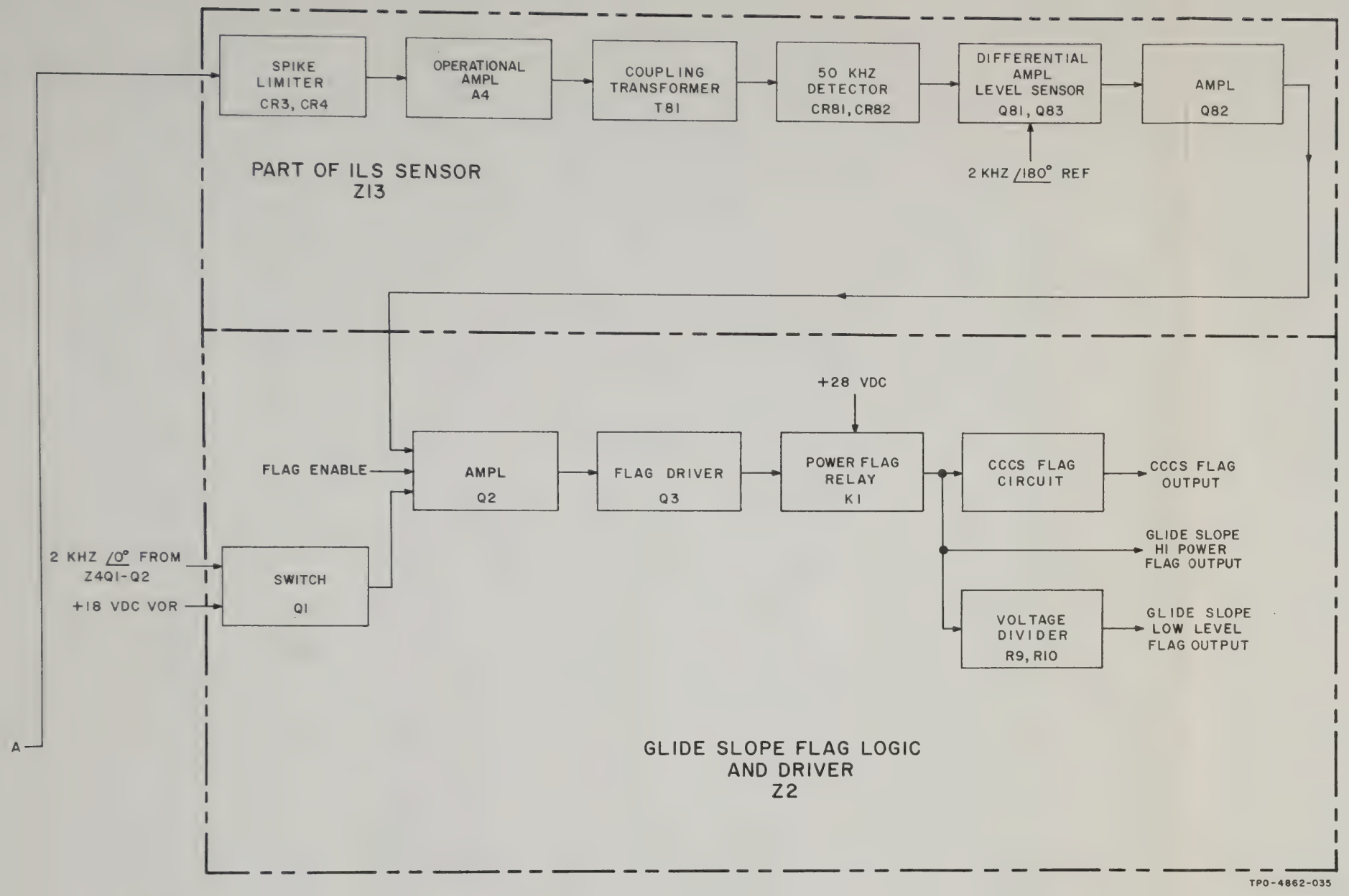
Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 2 of 3)
Figure 17


2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
AGC OUTPUT AMPL Q8
PART OF Z1
AGC
PART OF ILS SENSOR Z13
DIFFERENCE MOD/CHOPPER Q1
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
A
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
DIFFERENCE MOD/CHOPPER Q2
50 KHZ OSC Q24
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TPO-4862-035

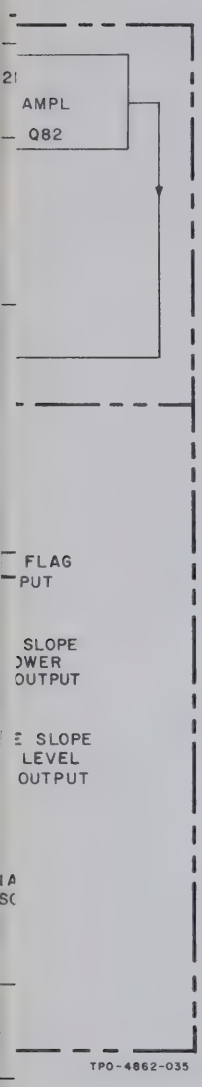


Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 3 of 3)
Figure 17


2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
AGC OUTPUT AMPL Q8
PART OF Z1
AGC
PART OF ILS SENSOR Z13
DIFFERENCE MOD/CHOPPER Q1
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
A
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
DIFFERENCE MOD/CHOPPER Q2
50 KHZ OSC Q24
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TP0-4862-035



Glideslope Receiver Planar Assembly, Detailed Block Diagram With 1-Piece UHF Front End Casting (Sheet 3 of 3)
Figure 17


AMPL
Q82
FLAG
SLOPE
SLOPE
LEVEL
OUTPUT
TP0-4862-035

51RV-2B VOR/ILS Receiver - Disassembly

1. GENERAL.

This section presents instructions for disassembling the 51RV-2B VOR/ILS Receiver. The 51RV-2B should be disassembled only when repair is necessary.

CAUTION: BE SURE THAT POWER CABLE IS REMOVED BEFORE DISASSEMBLING ANY PORTION OF THE EQUIPMENT. DISASSEMBLING THE EQUIPMENT WITH THE POWER CABLE CONNECTED MAY CAUSE VOLTAGE TRANSIENTS THAT COULD DESTROY THE TRANSISTORS.

2. PROCEDURES.

A. Front Panel Removal.

NOTE: The front panel should be removed only to provide access to adjustment controls or to permit removal of the 680T-1 VHF Synthesizer while the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assemblies remain intact and covered. For complete disassembly procedures, begin with paragraph 2.B.

(1) Remove three screws securing front panel at top front and three screws securing front panel at bottom front of dust covers (both wide and narrow dust cover).

(2) Remove front panel from 51RV-2B.

B. Dust Cover Removal.

(1) 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assemblies Dust Cover Removal. (Wide dust cover.)

NOTE: Front panel should be in place to facilitate removal of this dust cover.

(a) Remove two screws from top rear and two screws from bottom rear of the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assembly dust cover.

(b) Remove one screw from top front and one screw from bottom front of the 680T-1 VHF Synthesizer dust cover.

(c) Remove one screw from rear side of the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver dust cover.

(d) Separate front panel and the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver dust cover from remainder of 51RV-2B.

(2) 680T-1 VHF Synthesizer Planar Assembly Dust Cover Removal. (Narrow dust cover.)

NOTE: To remove the 680T-1 VHF Synthesizer as an individual planar assembly, perform the procedures as indicated in paragraph 2.A, and proceed to step (a) below.

To remove the 680T-1 VHF Synthesizer as part of a complete disassembly procedure, perform the procedures as indicated in paragraphs 2.A and 2.B.(1), and proceed to step (a) below.

(a) Remove the 680T-1 VHF Synthesizer by loosening recessed captive screw securing vhf synthesizer to interconnect unit.

(b) Remove one screw from each side of the 680T-1 VHF Synthesizer dust cover (narrow dust cover).

(c) Remove one screw from top rear and one screw from bottom rear of the 680T-1 VHF Synthesizer dust cover.

(d) Remove the 680T-1 VHF Synthesizer from dust cover.

C. Planar Assembly Removal.

(1) Remove dust covers as directed in paragraph 2.B.

(2) Remove the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, or 951A-1 Glideslope Receiver Planar Assembly by loosening corresponding captive recessed screw securing planar assemblies to interconnect unit.

51RV-2B VOR/ILS Receiver - Cleaning

(Not Applicable)

51RV-2B VOR/ILS Receiver - Inspection/Check

(Not Applicable)

51RV-2B VOR/ILS Receiver - Repair

(Not Applicable)

51RV-2B VOR/ILS Receiver - Assembly

1. GENERAL.

This section presents instructions for assembling the 51RV-2B VOR/ILS Receiver.

2. PROCEDURES.

A. Planar Assembly Replacement.

(1) Mate 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver to correct connector on interconnect unit.

(2) Secure each planar assembly to interconnect unit with corresponding recessed captive screw.

B. Dust Cover Replacement.

(1) 680T-1 VHF Synthesizer Planar Assembly Dust Cover Replacement.

(a) Insert the 680T-1 VHF Synthesizer into dust cover (narrow dust cover).

(b) Replace one screw at top rear and one screw at bottom rear of dust cover.

(c) Replace one screw at each side of the 680T-1 VHF Synthesizer dust cover.

(d) Mate the 680T-1 VHF Synthesizer to correct connector on interconnect unit, and secure with recessed captive screw on rear of interconnect unit.

NOTE: If the front panel was removed from the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver dust cover, then proceed to paragraph 2.C.

(2) 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assemblies Dust Cover Replacement. (Wide dust cover.)

(a) Slide dust cover with front panel attached over the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver.

CAUTION: ENSURE THAT ALL TRACKS, RAILS AND TABS WITHIN THE DUST COVER ALIGN PROPERLY.

(b) Replace one screw at rear of the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver dust cover.

(c) Replace one screw at top front and one screw at bottom front of the 680T-1 VHF Synthesizer dust cover.

(d) Replace two screws at top rear and two screws at bottom rear of the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glide-slope Receiver dust cover.

C. Front Panel Replacement.

(1) Position front panel on front of the 51RV-2B with tabs extending under both dust covers.

(2) Secure front panel with three screws at top front and three screws at bottom front of dust covers.

51RV-2B VOR/ILS Receiver - Fits and Clearances

(Not Applicable)

51RV-2B VOR/ILS Receiver - Testing

1. GENERAL

This section presents the procedures for bench testing the 51RV-2B VOR/ILS Receiver. A suspect or faulty 51RV-2B should first be subjected to the troubleshooting procedures. Results obtained from the test procedures will enable the technician to determine if maintenance is necessary.

2. TEST EQUIPMENT AND POWER REQUIREMENTS.

A. Test Equipment.

Refer to the special tools, fixtures, and equipment section of this manual for test equipment required to test the 51RV-2B VOR/ILS Receiver.

CAUTION: ENSURE THAT ALL TEST EQUIPMENT IS PROPERLY CALIBRATED BEFORE BEGINNING ANY TEST. PARAGRAPH 4 IN THIS SECTION PROVIDES PROCEDURES TO ENSURE THAT THE CORRECT PERCENTAGES OF MODULATION ARE PROVIDED BY THE 211-A, 232-A, AND 479S-3 SIGNAL GENERATORS.

B. Power Sources.

A +27.5-volt dc ±2 percent power source, a 26-volt ±2 percent 400-Hz ±5 percent power source, and a 115-volt ±10 percent 60-Hz power source are required to test the 51RV-2B VOR/ILS Receiver.

3. DEFINITION OF STANDARD TEST SIGNALS.

A. General.

The following paragraphs provide definitions for the standard test signals used to test the 51RV-2B.

NOTE: All of the standard glideslope test signals in this section are provided by the Boonton 232-A Glideslope Signal Generator. All of the standard VOR and localizer test signals are provided by the Collins 479S-3 Audio Signal Generator modulating a Boonton 211-A Signal Generator. Refer to paragraph 4 in this section for recommended setup procedures for the signal generators.

B. Input Levels.

Unless otherwise specified, all rf input levels refer to the voltage at the input to a 6-db, 50-ohm pad connected between the applicable signal generator and the test jig VOR/LOC ANT jack or GS ANT jack, or the 977A-1 Test Panel VHF IN jack or UHF IN jack.

C. Standard Glideslope Test Signals.

(1) Glideslope Test Signal.

A 700-microvolt rf carrier is amplitude modulated simultaneously with a 90-Hz ±0.3 percent and a 150-Hz ±0.3 percent signal so that the sum of their separate modulation percentages equals 80 ±2 percent. (When each signal is applied separately, the carrier is modulated 40 ±2 percent.)

NOTE: A correct indication on the 232-A PERCENT MODULATION meter will be approximately 50 percent when both the 90- and 150-Hz signals are correctly adjusted, and a standard glideslope centering signal is being used. Refer to paragraph 4.B.

CAUTION: NO EFFORT SHOULD BE MADE TO OBTAIN AN 80-PERCENT MODULATION INDICATION ON THE 232-A PERCENT MODULATION METER.

(2) Glideslope Centering Signal.

A standard glideslope centering signal consists of the glideslope test signal (paragraph 3.C.(1)) where the difference in depth of modulation of the 90 and 150 Hz is less than 0.2 percent (0-DB on 232-A TONE RATIO control).

(3) Glideslope Deviation Signal.

A standard glideslope deviation signal consists of the glideslope test signal (paragraph 3.C.(1)) where the difference in depth of modulation between the 90-Hz and 150-Hz signals is a ratio of 2.0 db, and a deflection of 78 microamperes is indicated with an rf input level of 700 microvolts. (232-A TONE RATIO control to either 2.0 db position.)

D. Standard VOR Test Signals.

(1) VOR Test Signal.

An rf carrier, at an output level of 1000 microvolts, is amplitude modulated simultaneously with a 30-percent, 9960-Hz subcarrier and a 30-percent, 30-Hz variable phase signal. The 9960-Hz subcarrier is frequency modulated at a deviation ratio of 16 by a 30-Hz reference phase signal. The phase of the variable signal can be varied with respect to the reference phase signal.

(2) VOR Audio Test Signal.

A standard VOR audio test signal consists of the VOR test signal described above to which is added a 1000-Hz signal amplitude modulated 30 percent.

(3) Audio Test Signal.

An rf carrier is amplitude modulated 30 percent by a 1000-Hz signal.

E. Standard Localizer Test Signal.

(1) Localizer Test Signal.

An rf carrier, at an input level of 1000 microvolts, is amplitude modulated simultaneously with a 90-Hz ±0.3 percent and a 150-Hz ±0.3 percent signal, so that the separate modulation percentages are equal, and their sum equals 40 ±2.0 percent. (When each signal is applied separately, the carrier is modulated 20 ±2 percent.)

NOTE: A correct indication on the 211-A PERCENT MODULATION meter will be approximately 32 percent when both the 90- and 150-Hz signals are correctly adjusted and a standard localizer centering signal is being used. Refer to paragraph 4.C.

(2) Localizer Centering Signal.

A standard localizer centering signal consists of the localizer test signal (paragraph 3.E.(1)) where the difference in depth of modulation of the 90 and 150 Hz is less than 0.002 volt (0.1 db). (0 db on 479S-3 TONE LOCALIZER switch.)

(3) Localizer Deviation Signal.

A standard localizer deviation signal consists of the localizer test signal (paragraph 3.E.(1)) where the difference in depth of modulation of the 90 and 150 Hz is 0.093 ±0.002 volt (4.0 ±0.1 db) (either of the 4 DB positions on 479S-3 TONE LOCALIZER switch.)

NOTE: When the difference in depth of modulation of the 90 Hz is greater than the 150 Hz, a deflection to the right occurs. When the difference in depth of modulation of the 150 Hz is greater than the 90 Hz, a deflection to the left occurs.

(4) Localizer Audio Signal.

A standard localizer audio signal consists of the localizer test signal (paragraph 3.E.(1)) to which is added an audio signal amplitude modulating the rf carrier 30 percent.

4. TEST EQUIPMENT CALIBRATION.

A. General.

The following paragraphs provide procedures to ensure that the percent of modulation of the recommended signal generators (Boonton 232-A Glideslope Signal Generator and Boonton 211-A Signal Generator) are correct. Procedures are also provided for calibrating the VOR signal, and 90/150-Hz signals (for localizer) provided by the Collins 479S-3 Audio Signal Generator.

NOTE: Allow a minimum warmup time of 15 minutes before proceeding with the percent modulation calibration procedures.

B. Boonton 232-A Glideslope Signal Generator Percent Modulation Calibration.

Ensure that the 232-A is properly calibrated and adjusted to provide a standard glideslope centering signal as described in paragraph 3. C. (1). Perform the following procedures to obtain correct modulation percentages.

(1) Parallel a dc and an ac (rms) vtvm across the 232-A METER CALIB test points. (An HP-410B may be used by switching between ac and dc as required.)

NOTE: Ensure that the ac and dc meters are isolated from ground. Adjust 232-A MOD LEVEL control to approximately 40 percent before proceeding to steps (2), (3), and (4).

(2) Position 232-A CARRIER switch to OFF, MOD switch to 90/150~ , and DB TONE RATIO switch to CAL 90. Adjust 232-A ZERO control until CARRIER MONITOR meter indicates 0. Observe and record dc vtvm indication (approximately +27 volts dc).

(3) Position 232-A CARRIER switch to RF. Adjust 232-A CARRIER ADJUST control for an exact 22-volt increase as indicated on dc vtvm.

(4) Adjust 232-A MON CAL control (located on 232-A chassis) for red line indication on CARRIER MONITOR meter.

(5) Repeat steps (3) and (4) until no further adjustments are necessary.

(6) The 90-Hz tone (DB TONE RATIO to CAL 90~) can now be adjusted for exactly 40 percent modulation. Observe ac vtvm and adjust calibration. Refer to the 232-A instruction book for adjustment of the 90- and 150-Hz tone controls. After calibration, repeat steps (1) through (7).

(7) Position 232-A DB TONE RATIO switch to CAL 150~ . If ac vtvm indication is not 6.37 volts ac (rms), then 232-A requires calibration. Refer to the 232-A instruction book for adjustment of the 90- and 150-Hz tone controls. After calibration, repeat steps (1) through (7).

NOTE: Percentages of modulation other than 40 percent for each tone can be computed using 1 volt ac (rms) as equal to 6.36 percent of modulation (approximately linear throughout the 232-A modulation range).

C. Boonton 211-A Signal Generator Percent Modulation Calibration.

Ensure that the 211-A is properly calibrated and adjusted before proceeding.

NOTE: If 211-A already has modulation monitoring jacks installed, then disregard steps (1) and (2), and proceed directly to step (3).

(1) Refer to the 211-A instruction book and locate the negative terminal of the RF MONITOR meter. Install a black tip jack on the 211-A front panel (isolated from ground). Connect a wire from negative terminal of RF MONITOR meter to black tip jack.

(2) Refer to the 211-A instruction book and locate the arm of control P304. Install a red tip jack on the 211-A front panel (isolated from ground) adjacent to the black tip jack installed in step (1). Connect a wire from the arm of P304 to red tip jack.

(3) Parallel a dc and an ac (rms) vtvm across the negative (black) and positive (red) tip jacks. Ensure that each vtvm is calibrated. (An HP-410B may be used by switching between ac and dc as required.)

NOTE: Ensure that ac and dc meters are isolated from ground.

(4) Position 211-A OSC SEL switch to OFF. Electrically zero the dc vtvm using the 211-A RF MONITOR meter ADJ ZERO control.

(5) Electrically zero the 211-A PERCENT MODULATION meter using the adjacent ADJ ZERO control.

(6) Position the 211-A OSC SEL switch to MO. Observe dc vtvm and adjust 211-A RF LEVEL control for an indication of +26 volts dc (should correspond to red line indication on RF MONITOR meter).

(7) Repeat steps (4), (5), and (6) until no further adjustments are necessary.

(8) Percentages of modulation and their corresponding ac rms voltages can now be obtained. For 20 percent modulation, observe ac vtvm and adjust 211-A MOD LEVEL control for an indication of 3.75 volts ac (rms). For 30 percent modulation, observe ac vtvm and adjust 211-A MOD LEVEL control for an indication of 5.62 volts ac (rms).

NOTE: Percentages of modulation other than 20 and 30 percent can be computed using 1 volt ac (rms) as equal to 5.38 percent of modulation (approximately linear throughout the 211-A modulation range).

D. Collins 479S-3 Audio Signal Generator Calibration.

(1) VOR Calibration.

(a) Position 479S-3 FUNCTION SELECTOR to CAL.

(b) Position SPECIFIC SIGNAL SELECTOR to 30~ VARϕ.

(c) Connect ac (rms) vtvm to 479S-3 MOD OUTPUT connector.

(d) Open 479S-3 potentiometer access door and adjust 30~ VARϕ control for an indication of 0.5 volt rms on vtvm. Lock potentiometer shaft.

(e) Position SPECIFIC SIGNAL SELECTOR to 9960 FM.

(f) Adjust 9960 FM control (behind potentiometer access door) for an indication of 0.5 volt rms on vtvm. Lock potentiometer shaft.

(g) Position FUNCTION SELECTOR to ODR. A standard VOR test signal is now available at the 479S-3 MOD OUTPUT connector.

(2) 90/150-Hz Localizer Tone Calibration.

(a) Position 479S-3 FUNCTION SELECTOR to CAL.

(b) Position SPECIFIC SIGNAL SELECTOR to 90 to 150~.

(c) Connect ac (rms) vtvm to 479S-3 MOD OUTPUT connector.

(d) Position 479S-3 TONE LOCALIZER control to CAL 90~.

(e) Open 479S-3 potentiometer access door and adjust 90~ control for an indication of 0.33 volt rms on vtvm. Lock potentiometer shaft.

(f) Position 479S-3 TONE LOCALIZER control to CAL 150~.

(g) Adjust 150 control (behind potentiometer access door) for an indication of 0.33 volt rms. Lock potentiometer shaft.

(h) Position FUNCTION SELECTOR to TONE LOC. Position TONE LOCALIZER control to 0. A standard localizer centering signal is now available at the 479S-3 MOD OUTPUT connector.

5. TEST PROCEDURES.

A. Use of Test Procedures.

The test procedures for the 51RV-2B are presented in tabular form. Two separate procedures are given. Procedure 1 uses standard test equipment plus a fabricated test jig, test connector adapter unit, and planar assembly extender cables. Procedure 2 uses standard test equipment with the Collins 977A-1 Test Panel.

Directions for using the tabular test procedures follow:

(1) The 51RV-2B should be completely assembled, and all dust covers should be in place before proceeding with the test.

(2) When any block associated with a test equipment setting is empty, all pertinent controls have been properly set in a previous step and do not have to be changed.

(3) All related test setup diagrams and tables of initial test equipment control settings are shown before the test procedure. These diagrams and tables are discussed in paragraphs 5.B.(1) and 5.B.(2).

(4) Functions of the various columns on the test procedure are as follows:

(a) The TEST column gives the sequential test number, and the name of the test being performed.

(b) The TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2 columns provide instructions pertaining to switch or control settings for the 232-A, 211-A, and 479S-3 Signal Generators. Only the switch or control mentioned in a column for a given test need be changed or adjusted. All other switches or controls have been properly positioned or adjusted and do not have to be changed.

(c) The PROCEDURE 1 USING STANDARD TEST EQUIPMENT columns provide instructions for testing the 51RV-2B using the customer fabricated test jig and test connector adapter unit. An external control unit, such as the Collins 313N-( ) is also required. The PROCEDURE column provides instructions required to perform a given test. The OUTPUT column provides test point, test equipment, test limits, and other end result indications.

(d) The PROCEDURE 2 USING 977A-1 TEST PANEL columns provide instructions for testing the 51RV-2B using the Collins 977A-1 Test Panel. The FREQUENCY column shows the required frequency (frequency controls provided by 977A-1). The PROCEDURE column provides instructions required to perform a given test. The OUTPUT columns list the various outputs from the 977A-1 (DC VOLTAGE, AC VOLTS, and CRO) and also provide output test point locations (on the 977A-1), test equipment used to measure the output, and test limits or other end result indications.

NOTE: When a switch position is shown under the DC VOLTAGE, AC VOLTS, or CRO columns, it is the responsibility of the test technicians to ensure that the appropriate 977A-1 switches are adjusted to select the specified parameter.

(e) The COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2 column is used for notes and/or supplemental information pertaining to a given test. The information in this column is common to either procedure 1 or procedure 2.

(5) Performing a complete test requires that all steps of the procedure be completed in the order shown.

(6) It will be possible to isolate many problems directly from performing the test procedures. Refer to the troubleshooting section of this manual for further information concerning location of trouble.

(7) The following abbreviations are used in the test procedure.

ABBREVIATION	DEFINITION
db	Decibel(s)
Hz	Hertz
ma	Milliampere(s)
MHz	Megahertz
mv	Millivolt(s)
rms	Root mean square
rf	Radio frequency
ua	Microamperes(s)

ABBREVIATION	DEFINITION
uv	Microvolt(s)
vac	Volts ac
vdc	Volts dc
NA	Not applicable

B. Test Procedures.

(1) Test Setup.

Test setup diagrams are shown in figures 701 and 702. Figure 701 is the test setup for testing the 51RV-2B using standard test equipment. The test equipment shown in figure 701 is specified in figure 1001 of the special tools, fixtures, and equipment section. Fabricate the 51RV-2B test jig and test connector adapter unit as called out in figure 1001.

Figure 702 is the test setup for testing the 51RV-2B using the 977A-1 Test Panel. Figure 1001 specifies the test equipment shown in figure 702.

Ensure that all test equipment is properly calibrated before beginning any test (refer to paragraph 4 in this section).

Instructions for connecting the test jig and test connector adapter unit or the 977A-1 to the 51RV-2B are contained in the test procedures.

(2) Equipment Setup.

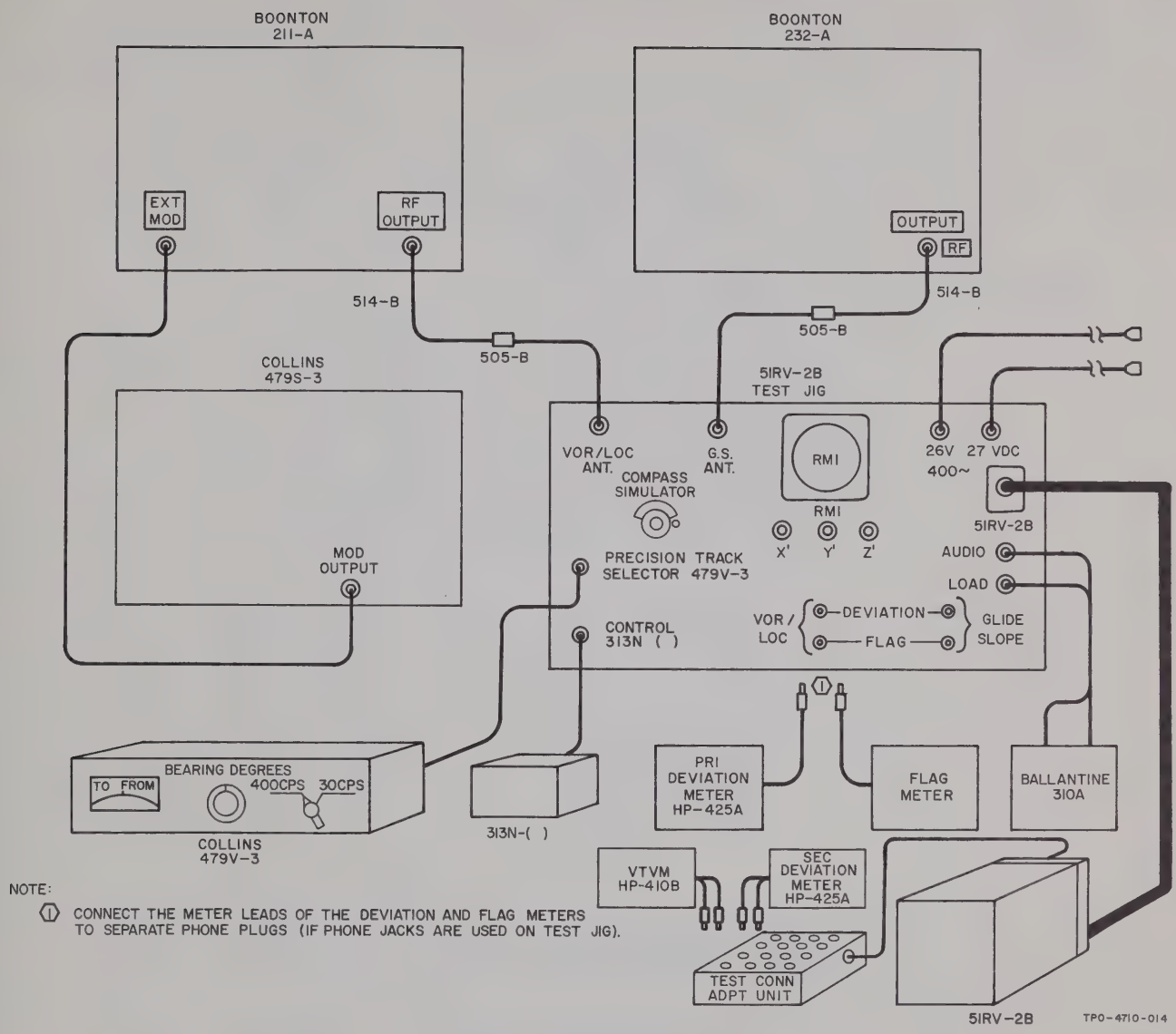
Figure 703 is a table of initial test equipment control settings. All controls or switches on the applicable test equipment should be positioned as specified in figure 703 before beginning the test procedures. If the position of any control or switch is not specified for any piece of test equipment, that setting is not relevant to the test procedure.

NOTE: Allow 15 minutes warmup time for all test equipment.

(3) Procedures.

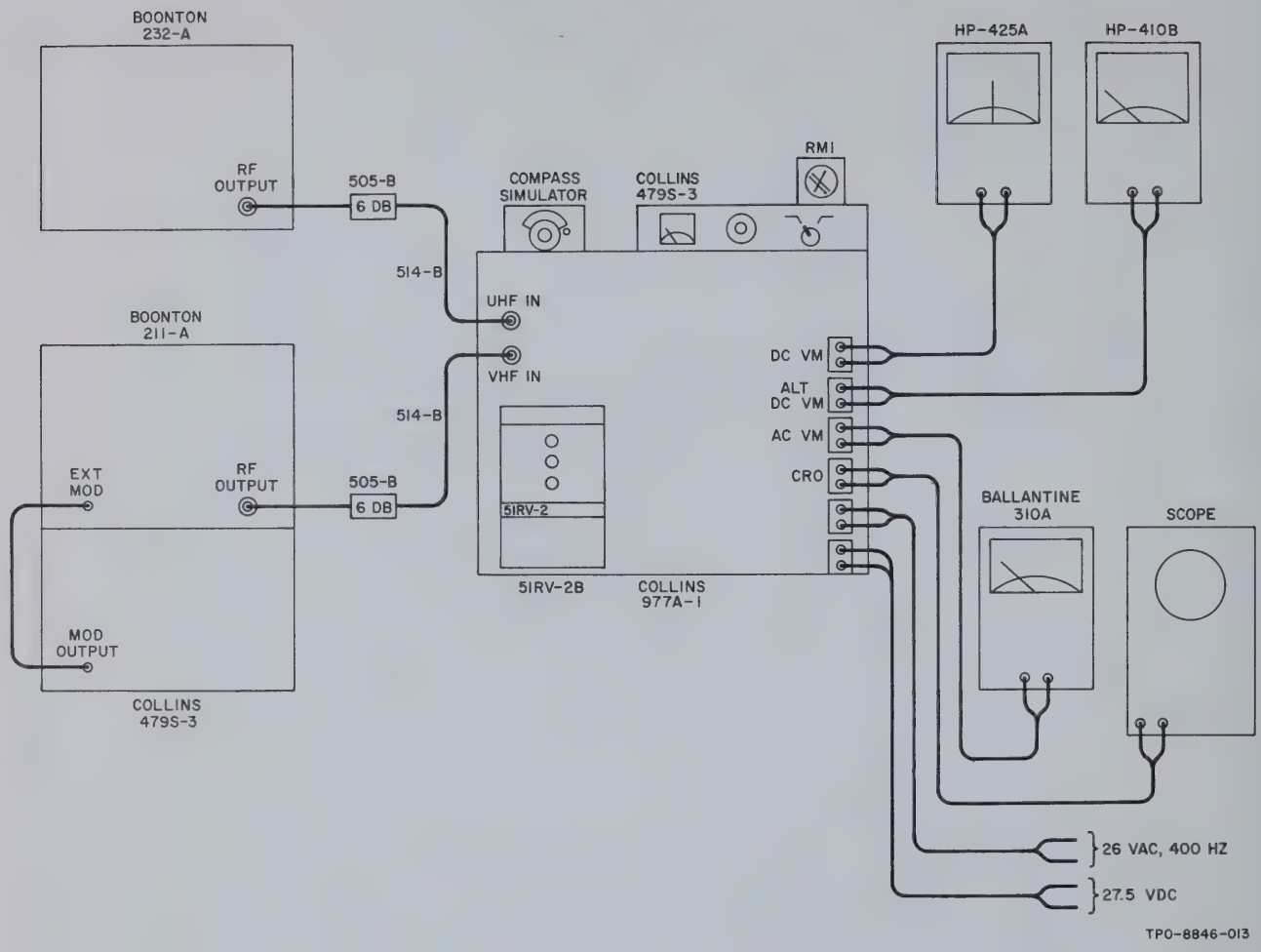
The test procedures are shown in figure 704. Proceed to figure 704 and begin with test number 0.1.

NOTE: Each separate test number and name is contained on an individual page. However, test equipment control and switch settings from a previous page (test) are NOT repeated at the beginning of each new page. For many of the tests, adjustments and results of previous tests will affect the adjustments and results of following tests. It is therefore recommended that the complete test procedure be accomplished beginning with test 0.1. By performing the complete test procedure, all test equipment control and switch settings are given as they are required, and do not have to be changed unless instructions to do so are shown in following tests. An index of the test numbers and names is shown below. If it is desired to perform only a given test (without performing all of the



51RV-2B VOR/ILS Receiver, Test Setup Diagram Using Standard Test Equipment
Figure 701

procedures up to the desired test) then the technician should scan the TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2 columns beginning with test 0.1, and adjust the test equipment as shown in following tests until the desired test is reached. The frequency setting of the 313N-( ) control or 977A-1 FREQUENCY switches should also be checked to ensure that the last frequency used for a previous test is selected.



51RV-2B VOR/ILS Receiver, Test Setup Diagram Using 977A-1 Test Panel
Figure 702

The test procedure index is as follows:

TEST NUMBER	TEST NAME
0.1	Test setup
1.0	Power supply check
2.0	Vhf NAV receiver tests
2.1.0	Sensitivity
2.2.0	Channel operation
2.3.0	Detector output
2.4.0	Audio output
3.0	VOR/LOC instrumentation tests
3.1.0	Localizer deviation and centering
3.2.0	VOR/LOC sensor
3.3.0	RMI pointer bias
3.4.0	Localizer flag current

TEST NUMBER	TEST NAME
3.5.0	VOR zero, tracking, balance, and sensitivity
3.6.0	Automatic VOR
3.7.0	On course gate width (VOR)
3.8.0	Off course gate width (VOR)
3.9.0	VOR deviation linearity
3.10.0	Automatic VOR gate level
4.0	Glideslope receiver tests
4.1.0	Glideslope sensitivity
4.2.0	Glideslope quieting and receiver gain
4.3.0	Glideslope centering and deviation
4.4.0	Glideslope sensor
4.5.0	Glideslope deviation monitor
4.6.0	Glideslope deviation check
5.0	Test generator and timer tests
5.1.0	Test generator, VOR section
5.2.0	Test generator, ILS section
6.0	End of test

TEST EQUIPMENT	CONTROL OR JACK	SETTING OR POSITION	COMMENTS
Boonton 232-A Glideslope Signal Generator	RF OUTPUT jack	Connect to test jig J3 for procedure 1. Connect to 977A-1 UHF IN for procedure 2.	Connect through a 6-db, 50-ohm pad.
	POWER switch	ON.	
	FREQUENCY switch	334.4 MC.	
	OUTPUT LEVEL control.	700 uv.	
	MOD switch	90-150~.	
	CARRIER switch	Per paragraph 4.B.	
	CARRIER ADJUST control		
	CARRIER MONITOR meter		

Test Equipment Initial Control/Switch Settings (Sheet 1 of 3)
Figure 703

TEST EQUIPMENT	CONTROL OR JACK	SETTING OR POSITION	COMMENTS
	MOD LEVEL control PERCENT MODULATION meter	Per paragraph 4.B.	
	DB TONE RATIO switch	2.0, 90 Hz greater than 150 Hz, after completing paragraph 4.B.	The 232-A is now adjusted to provide a standard glideslope deviation signal.
Boonton 211-A VHF Signal Generator	RF OUTPUT jack	Connect to test jig J4 for procedure 1. Connect to 977A-1 VHF IN for procedure 2.	Connect through a 6-db, 50-ohm pad.
	POWER switch	ON.	
	OSC SEL switch	MO.	
	FREQUENCY control	108.00 MC.	Carefully adjust FREQUENCY control around 108.00 MHZ for maximum indication on RF MONITOR meter.
	MOD RANGE switch	100%.	
	OUTPUT LEVEL control	1000 uv.	
	RF LEVEL control RF MONITOR meter ADJ ZERO control MOD LEVEL control PERCENT MODULATION meter	Per paragraph 4.C.	

Test Equipment Initial Control/Switch Settings (Sheet 2 of 3)
Figure 703

TEST EQUIPMENT	CONTROL OR JACK	SETTING OR POSITION	COMMENTS
	MOD switch	1000~ .	
	XTAL switch	114.9.	
	EXT MOD jack	Connect to 479S-3 MOD OUTPUT jack.	
Collins 479S-3 Audio Signal Generator	POWER switch	ON.	
	NOTE: Perform procedures of paragraph 4.D. before adjusting the following controls.		
	TONE LOCALIZER switch	4 DB (to the right).	
	PHASE ANGLE SELECTOR control	0 degree.	
	FUNCTION SELECTOR switch	SPECIFIC SIGNAL.	
	SPECIFIC SIGNAL SELECTOR switch	30~ VAR ϕ .	
	1000~ switch	OFF.	
	MOD OUTPUT jack	Connect to 211-A MOD jack.	
Collins 479V-3 Precision Track Selector	400 CPS/30 CPS switch	400 CPS.	
	BEARING DEGREES switch	180 degrees.	

Test Equipment Initial Control/Switch Settings (Sheet 3 of 3)
Figure 703

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
0.1	Test setup	Per figure 703. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.	Per figure 703, adjust MOD LEVEL control to 30 percent after completing paragraph 4.C. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.	Per figure 703. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.		See note in COMMENTS column. Connect J1 of 51RV-2B test jig (figure 1002) to P1 at rear of 51RV-2B Interconnect Unit. Connect J2 of test connector adapter unit (figure 1003) to P2 at rear of 51RV-2B Interconnect Unit. Connect +27.5 vdc and 26 vac, 400-Hz power to 51RV-2B test jig (power switch on control unit OFF). Position test jig switches as follows: S1 to X1, S2 to X1, and S3 to LOAD. Use test setup shown in figure 701.			
1.0	Power supply check				108.10 MHz	Apply power (power switch on control unit to PWR) and observe meter.	Test connector adapter unit J26 and grd	Fluke 801B	+18.0 ±0.5 vdc
1.1						Observe meter.	Test connector adapter unit J26 and grd	Fluke 801B	+5.0 ±0.25 vdc

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 1 of 29)
Figure 704

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
0.1	Test setup	Per figure 703. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.	Per figure 703, adjust MOD LEVEL control to 30 percent after completing paragraph 4.C. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.	Per figure 703. NOTE: Leave all controls/switches set per figure 703 until instructed to change any control/switch setting.		See note in COMMENTS column. Connect J1 of 51RV-2B test jig (figure 1002) to P1 at rear of 51RV-2B Interconnect Unit. Connect J2 of test connector adapter unit (figure 1003) to P2 at rear of 51RV-2B Interconnect Unit. Connect +27.5 vdc and 26 vac, 400-Hz power to 51RV-2B test jig (power switch on control unit OFF). Position test jig switches as follows: S1 to X1, S2 to X1, and S3 to LOAD. Use test setup shown in figure 701.					See note in COMMENTS column. Connect 51RV-2B to 51RV-2 connector on 977A-1. Connect +27.5 vdc and 26 vac, 400-Hz power to 977A-1 (AC and DC INPUT POWER switches off). Position 977A-1 switches as follows: MODE to ILS, 900~ and NAV DISABLE to off (down), VOR, UP-LT, and DN-RT SELF-TEST to off (down), and DEVIATION ALARM TEST to OFF. Use test setup shown in figure 702.							NOTE: The Collins 479V-3 Precision Track Selector, the RMI, and the precision synchro with gear head (Collins 516) should be connected to the test jig or the 977A-1 as shown on the test jig schematic diagram (figure 1002) or the 977A-1 schematic diagram. (Refer to the 51RV-2 Test Equipment Instruction Book, Collins part number 523-0759909.)
1.0	Power supply check				108.10 MHz	Apply power (power switch on control unit to PWR) and observe meter.	Test connector adapter unit J26 and grd	Fluke 801B	+18.0 ±0.5 vdc	108.10 MHz	Position DC INPUT POWER switch on and observe meter.	18 V ILS			DC VM	Fluke 801B	+18.0 ±0.5 vdc	If the results obtained are other than those specified, refer to the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual testing section and perform test 1.0. (Vhf NAV receiver will have to be removed from dust cover. Refer to disassembly section of this manual.)
1.1						Observe meter.	Test connector adapter unit J26 and grd	Fluke 801B	+5.0 ±0.25 vdc		Observe meter. Position 977A-1 MODE switch to VOR.	UNIT 5 V			DC VM	Fluke 801B	+5.0 ±0.25 vdc	

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 1 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	See note in COMMENTS column. Connect 51RV-2B to 51RV-2 connector on 977A-1. Connect +27.5 vdc and 26 vac, 400-Hz power to 977A-1 (AC and DC INPUT POWER switches off). Position 977A-1 switches as follows: MODE to ILS, 900~ and NAV DISABLE to off (down), VOR, UP-LT, and DN-RT SELF-TEST to off (down), and DEVIATION ALARM TEST to OFF. Use test setup shown in figure 702.							NOTE: The Collins 479V-3 Precision Track Selector, the RMI, and the precision synchro with gear head (Collins 516) should be connected to the test jig or the 977A-1 as shown on the test jig schematic diagram (figure 1002) or the 977A-1 schematic diagram. (Refer to the 51RV-2 Test Equipment Instruction Book, Collins part number 523-0759909.)
108.10 MHz	Position DC INPUT POWER switch on and observe meter.	18 V ILS			DC VM	Fluke 801B	+18.0 ±0.5 vdc	If the results obtained are other than those specified, refer to the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual testing section and perform test 1.0. (Vhf NAV receiver will have to be removed from dust cover. Refer to disassembly section of this manual.)
	Observe meter. Position 977A-1 MODE switch to VOR.	UNIT 5 V			DC VM	Fluke 801B	+5.0 ±0.25 vdc	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
2.0	1051B-1 VHF NAV Receiver tests					Remove front panel from 51RV-2B per disassembly section of this manual.			
2.1.0	Sensitivity		Adjust FREQUENCY control per procedure		108.00 MHz	Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC until result is obtained.	Test connector adapter until J10 and grd	HP-400D	Adjusted for m imum dc
2.1.1			OUTPUT LEVEL control to 3 uv			Observe meter and record db indication.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded
2.1.2			OUTPUT LEVEL control to 0 uv (full counterclockwise)			Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 2.1.1.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded Not less than 6 db

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 2 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	See note in COMMENTS column. Connect 51RV-2B to 51RV-2 connector on 977A-1. Connect +27.5 vdc and 26 vac, 400-Hz power to 977A-1 (AC and DC INPUT POWER switches off). Position 977A-1 switches as follows: MODE to ILS, 900~ and NAV DISABLE to off (down), VOR, UP-LT, and DN-RT SELF-TEST to off (down), and DEVIATION ALARM TEST to OFF. Use test setup shown in figure 702.							NOTE: The Collins 479V-3 Precision Track Selector, the RMI, and the precision synchro with gear head (Collins 516) should be connected to the test jig or the 977A-1 as shown on the test jig schematic diagram (figure 1002) or the 977A-1 schematic diagram. (Refer to the 51RV-2 Test Equipment Instruction Book, Collins part number 523-0759909.)
108.10 MHz	Position DC INPUT POWER switch on and observe meter.	18 V ILS			DC VM	Fluke 801B	+18.0 ±0.5 vdc	If the results obtained are other than those specified, refer to the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual testing section and perform test 1.0. (Vhf NAV receiver will have to be removed from dust cover. Refer to disassembly section of this manual.)
	Observe meter. Position 977A-1 MODE switch to VOR.	UNIT 5 V			DC VM	Fluke 801B	+5.0 ±0.25 vdc	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
2.0	1051B-1 VHF NAV Receiver tests					Remove front panel from 51RV-2B per disassembly section of this manual.					Remove front panel from 51RV-2B per disassembly section of this manual.							
2.1.0	Sensitivity		Adjust FREQUENCY control per procedure		108.00 MHz	Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC until result is obtained.	Test connector adapter until J10 and grd	HP-400D	Adjusted for maximum dc	108.00 MHz	Position AC INPUT POWER switch on. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC until result is obtained.	VHF AGC			DC VM	HP-400D	Adjusted for maximum dc	Maximum dc indicates that 211-A is adjusted to 108.00 MHz.
2.1.1			OUTPUT LEVEL control to 3 uv			Observe meter and record db indication.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded		Observe meter and record db indication.		VL AF		AC VM	Ballantine 310A	Recorded	
2.1.2			OUTPUT LEVEL control to 0 uv (full counterclockwise)			Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 2.1.1.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded Not less than 6 db		Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 2.1.1.		VL AF		AC VM	Ballantine 310A	Recorded Not less than 6 db	

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 2 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Remove front panel from 51RV-2B per disassembly section of this manual.							
108.00 MHz	Position AC INPUT POWER switch on. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC until result is obtained.	VHF AGC			DC VM	HP-400D	Adjusted for maximum dc	Maximum dc indicates that 211-A is adjusted to 108.00 MHz.
	Observe meter and record db indication.		VL AF		AC VM	Ballantine 310A	Recorded	
	Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 2.1.1.		VL AF		AC VM	Ballantine 310A	Recorded Not less than 6 db	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
2.2.0	Channel operation		OUTPUT LEVEL control to 1000 uv			Observe oscilloscope.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000 Hz waveform observed
2.2.1			Adjust FREQUENCY control per procedure		108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A (adjust FREQUENCY control and RF LEVEL for red line on each frequency) and 313N-( ) control to each listed frequency. Observe oscilloscope at each frequency.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000 Hz waveform observed
2.2.2					See procedure	Adjust oscilloscope for dc operation and a horizontal sweep time of 0.5 s/cm. Adjust vertical sensitivity for 5 volts/cm. Adjust vertical position control so that trace line is about 2 cm above center. Adjust 313N-( ) control to 110.10 MHz. Actuate UP/L test switch at front of 51RV-2B and observe test jig H1 POWER VOR/LOC FLAG light. When light comes on (approximately 3 seconds after actuating UP/L test switch), observe trace on oscilloscope while quickly changing 313N-( ) NAV frequency from 110.10 to 111.10 MHz (repeat several times if necessary). Release UP/L test switch and repeat last paragraph using test point shown at right. Release UP/L test switch and remove oscilloscope.	Test connector adapter unit J29 and grd Test connector adapter unit J27 and grd	Oscilloscope Oscilloscope	Trace momentarily goes toward 0 volt when frequency change is made. Trace momentarily goes toward 0 volt when frequency change is made.
2.2.3						Actuate UP/L test switch. After approximately 3 seconds, short test connector adapter unit J29 to ground and observe indicator. Remove jumper from J29 (leave other end of jumper grounded). Install free end of jumper in test connector adapter unit J27 and observe indicator. (If more than 20 seconds elapse during the time the UP/L test switch was actuated, release the test switch, and actuate test switch again.) Release UP/L test switch.	Test jig HI POWER VOR/LOC FLAG light Test jig HI POWER GLIDESLOPE FLAG light		Light goes off when test connector adapter unit J29 is grounded. Light goes off when test connector adapter unit J27 is grounded.

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 3 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Remove front panel from 51RV-2B per disassembly section of this manual.							
108.00 MHz	Position AC INPUT POWER switch on. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC until result is obtained.	VHF AGC			DC VM	HP-400D	Adjusted for maximum dc	Maximum dc indicates that 211-A is adjusted to 108.00 MHz.
	Observe meter and record db indication.		VL AF		AC VM	Ballantine 310A	Recorded	
	Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 2.1.1.		VL AF		AC VM	Ballantine 310A	Recorded Not less than 6 db	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
2.2.0	Channel operation		OUTPUT LEVEL control to 1000 uv			Observe oscilloscope.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000 Hz waveform observed		Observe oscilloscope			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	
2.2.1			Adjust FREQUENCY control per procedure		108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A (adjust FREQUENCY control and RF LEVEL for red line on each frequency) and 313N-( ) control to each listed frequency. Observe oscilloscope at each frequency.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000 Hz waveform observed	108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A (adjust FREQUENCY control and RF LEVEL for red line on each frequency) and 977A-1 FREQUENCY switches to each listed frequency (see note below). Observe oscilloscope at each frequency. NOTE: Position 977A-1 MODE switch to ILS for the following frequencies: 108.70, 109.15, and 111.35 MHz. MODE switch should be positioned to VOR for remaining frequencies.			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	This test checks the channeling of the vhf synthesizer and the vhf NAV receiver. If 1000-Hz waveform cannot be obtained on each listed frequency, the vhf synthesizer could be faulty. Perform the test procedure for the vhf synthesizer as outlined in the testing section of the 680T-1 VHF Synthesizer Planar Assembly Overhaul Manual.
2.2.2					See procedure	Adjust oscilloscope for dc operation and a horizontal sweep time of 0.5 s/cm. Adjust vertical sensitivity for 5 volts/cm. Adjust vertical position control so that trace line is about 2 cm above center. Adjust 313N-( ) control to 110.10 MHz. Actuate UP/L test switch at front of 51RV-2B and observe test jig HI POWER VOR/LOC FLAG light. When light comes on (approximately 3 seconds after actuating UP/L test switch), observe trace on oscilloscope while quickly changing 313N-( ) NAV frequency from 110.10 to 111.10 MHz (repeat several times if necessary). Release UP/L test switch and repeat last paragraph using test point shown at right. Release UP/L test switch and remove oscilloscope.	Test connector adapter unit J29 and grd Test connector adapter unit J27 and grd	Oscilloscope Oscilloscope	Trace momentarily goes toward 0 volt when frequency change is made. Trace momentarily goes toward 0 volt when frequency change is made.	See procedure	Position 977A-1 MODE switch to ILS. Adjust FREQUENCY switches to 108.10 MHz. Position 977A-1 UP-LT SELF-TEST switch on (up) and observe VL and GS POWER FLAG lights. When both lights come on (approximately 3 seconds after actuating UP-LT SELF-TEST switch), observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz. Position UP-LT SELF-TEST switch off (down).				UHF and VHF SYN LOCK lights		Both lights blink during frequency change.	This test checks the monitoring circuits in the uhf synthesizer.
2.2.3						Actuate UP/L test switch. After approximately 3 seconds, short test connector adapter unit J29 to ground and observe indicator. Remove jumper from J29 (leave other end of jumper grounded). Install free end of jumper in test connector adapter unit J27 and observe indicator. (If more than 20 seconds elapse during the time the UP/L test switch was actuated, release the test switch, and actuate test switch again.) Release UP/L test switch.	Test jig HI POWER VOR/LOC FLAG light Test jig HI POWER GLIDESLOPE FLAG light		Light goes off when test connector adapter unit J29 is grounded. Light goes off when test connector adapter unit J27 is grounded.		Position 977A-1 UP-LT SELF-TEST switch on (up) and observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz (wait approximately 3 seconds after actuating test switch before changing FREQUENCY switch). Position UP-LT SELF-TEST switch off (down). Position 977A-1 MODE switch to VOR.				VL and GS POWER FLAG lights		Both lights blink during frequency change.	

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe oscilloscope			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	
108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A (adjust FREQUENCY control and RF LEVEL for red line on each frequency) and 977A-1 FREQUENCY switches to each listed frequency (see note below). Observe oscilloscope at each frequency. NOTE: Position 977A-1 MODE switch to ILS for the following frequencies: 108.70, 109.15, and 111.35 MHz. MODE switch should be positioned to VOR for remaining frequencies.			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	This test checks the channeling of the vhf synthesizer and the vhf NAV receiver. If 1000-Hz waveform cannot be obtained on each listed frequency, the vhf synthesizer could be faulty. Perform the test procedure for the vhf synthesizer as outlined in the testing section of the 680T-1 VHF Synthesizer Planar Assembly Overhaul Manual.
See procedure	Position 977A-1 MODE switch to ILS. Adjust FREQUENCY switches to 108.10 MHz. Position 977A-1 UP-LT SELF-TEST switch on (up) and observe VL and GS POWER FLAG lights. When both lights come on (approximately 3 seconds after actuating UP-LT SELF-TEST switch), observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz. Position UP-LT SELF-TEST switch off (down).				UHF and VHF SYN LOCK lights		Both lights blink during frequency change.	This test checks the monitoring circuits in the uhf synthesizer.
	Position 977A-1 UP-LT SELF-TEST switch on (up) and observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz (wait approximately 3 seconds after actuating test switch before changing FREQUENCY switch). Position UP-LT SELF-TEST switch off (down). Position 977A-1 MODE switch to VOR.				VL and GS POWER FLAG lights		Both lights blink during frequency change.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
2.3.0	Detector output		OSC SEL switch to XTAL. MOD switch to EXT Adjust FREQUENCY control per procedure.		114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Recheck 211-A for 30-percent modulation.			
2.3.1						Observe meter.	Test connector adapter unit J13 and grd	Ballantine 310A	0.5 ± 0.02 vac

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe oscilloscope			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	
108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A (adjust FREQUENCY control and RF LEVEL for red line on each frequency) and 977A-1 FREQUENCY switches to each listed frequency (see note below). Observe oscilloscope at each frequency. NOTE: Position 977A-1 MODE switch to ILS for the following frequencies: 108.70, 109.15, and 111.35 MHz. MODE switch should be positioned to VOR for remaining frequencies.			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	This test checks the channeling of the vhf synthesizer and the vhf NAV receiver. If 1000-Hz waveform cannot be obtained on each listed frequency, the vhf synthesizer could be faulty. Perform the test procedure for the vhf synthesizer as outlined in the testing section of the 680T-1 VHF Synthesizer Planar Assembly Overhaul Manual.
See procedure	Position 977A-1 MODE switch to ILS. Adjust FREQUENCY switches to 108.10 MHz. Position 977A-1 UP-LT SELF-TEST switch on (up) and observe VL and GS POWER FLAG lights. When both lights come on (approximately 3 seconds after actuating UP-LT SELF-TEST switch), observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz. Position UP-LT SELF-TEST switch off (down).				UHF and VHF SYN LOCK lights		Both lights blink during frequency change.	This test checks the monitoring circuits in the uhf synthesizer.
	Position 977A-1 UP-LT SELF-TEST switch on (up) and observe indicators while quickly changing 977A-1 FREQUENCY switch from 108.10 to 109.10 MHz (wait approximately 3 seconds after actuating test switch before changing FREQUENCY switch). Position UP-LT SELF-TEST switch off (down). Position 977A-1 MODE switch to VOR.				VL and GS POWER FLAG lights		Both lights blink during frequency change.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
2.3.0	Detector output		OSC SEL switch to XTAL. MOD switch to EXT Adjust FREQUENCY control per procedure.		114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Recheck 211-A for 30-percent modulation.				114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Recheck 211-A for 30 percent modulation.							
2.3.1						Observe meter.	Test connector adapter unit J13 and grd	Ballantine 310A	0.5 ± 0.02 vac		Observe meter.		VHF DET AF		AC VM	Ballantine 310A	0.5 ±0.02 vac	If necessary, adjust VHF DET control (vhf receiver Z3R9) until result is obtained.

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Recheck 211-A for 30 percent modulation.							
	Observe meter.		VHF DET AF		AC VM	Ballantine 310A	0.5 ±0.02 vac	If necessary, adjust VHF DET control (vhf receiver Z3R9) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
2.4.0	Audio output		MOD switch to 100~			Observe meter.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	7.75 vac

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Recheck 211-A for 30 percent modulation.							
	Observe meter.		VHF DET AF		AC VM	Ballantine 310A	0.5 ±0.02 vac	If necessary, adjust VHF DET control (vhf receiver Z3R9) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
2.4.0	Audio output		MOD switch to 100%			Observe meter.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	7.75 vac		Observe meter.		VL AF		AC VM	Ballantine 310A	7.75 vac	If necessary, adjust AUD LVL control (vhf receiver Z3R6) until result is obtained.

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.		VL AF		AC VM	Ballantine 310A	7.75 vac	If necessary, adjust AUD LVL control (vhf receiver Z3R6) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.0	844A-1 VOR/ LOC Instrumentation tests					Complete all parts of tests 1.0 and 2.0 before proceeding with test 3.0.			
3.1.0	Localizer deviation and centering		Adjust MOD LEVEL control per procedure	FUNCTION SELECTOR switch to TONE LOC. TONE LOCALIZER switch to CAL 150 ~. After procedure column instructions are completed, position TONE LOCALIZER switch to O (see note in COMMENTS column).	110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Check 211-A PERCENT MODULATION meter for 20 percent. Adjust 211-A MOD LEVEL control if necessary. Position 479S-3 TONE LOCALIZER switch to CAL 90 ~. 211-A PERCENT MODULATION meter should indicate 20 percent.			
3.1.1				TONE LOCALIZER switch to 4DB (to the right).		Observe meter.	Test jig J7	HP-425A (FUNCTION switch to VOLTAGE unless otherwise specified.)	90 ua to the rig
3.1.2						Observe meter.	Test connector adapter unit J14 and J15.	HP-425A	90 ua to the rig
3.1.3				TONE LOCALIZER switch to O.		Observe meter.	Test jig J7	HP-425A	0 ua (centered)
3.1.4						Observe meter.	Test connector adapter unit J14 and J15	HP-425A	0 ua (centered)

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.		VL AF		AC VM	Ballantine 310A	7.75 vac	If necessary, adjust AUD LVL control (vhf receiver Z3R6) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.0	844A-1 VOR LOC Instrumentation tests					Complete all parts of tests 1.0 and 2.0 before proceeding with test 3.0.					Complete all parts of tests 1.0 and 2.0 before proceeding with test 3.0. Position 977A-1 MODE switch to ILS.							
3.1.0	Localizer deviation and centering		Adjust MOD LEVEL control per procedure	FUNCTION SELECTOR switch to TONE LOC. TONE LOCALIZER switch to CAL 150 ∿. After procedure column instructions are completed, position TONE LOCALIZER switch to O (see note in COMMENTS column).	110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Check 211-A PERCENT MODULATION meter for 20 percent. Adjust 211-A MOD LEVEL control if necessary. Position 479S-3 TONE LOCALIZER switch to CAL 90 ∿. 211-A PERCENT MODULATION meter should indicate 20 percent.				110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Check 211-A PERCENT MODULATION meter for 20 percent. Adjust 211-A MOD LEVEL control if necessary. Position 479S-3 TONE LOCALIZER switch to CAL 90 ∿. 211-A PERCENT MODULATION meter should indicate 20 percent.							
3.1.1				TONE LOCALIZER switch to 4DB (to the right).		Observe meter.	Test jig J7	HP-425A (FUNCTION switch to VOLTAGE unless otherwise specified.)	90 ua to the right		Observe meter.	VL DEV PRI			DC VM	HP-425A (FUNCTION switch to VOLTAGE unless otherwise specified)	90 ua to the right	If necessary, adjust PRI SENS control (VOR/LOC instrumentation Z1R201) until result is obtained.
3.1.2						Observe meter.	Test connector adapter unit J14 and J15.	HP-425A	90 ua to the right		Observe meter.	VL DEV SEC			DC VM	HP-425A	90 ua to the right	If necessary, adjust SEC SENS control (VOR/LOC instrumentation Z1R221) until result is obtained.
3.1.3				TONE LOCALIZER switch to O.		Observe meter.	Test jig J7	HP-425A	0 ua (centered)		Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (VOR/LOC instrumentation Z1R257) until result is obtained.
3.1.4						Observe meter.	Test connector adapter unit J14 and J15	HP-425A	0 ua (centered)		Observe meter.	VL DEV SEC			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Complete all parts of tests 1.0 and 2.0 before proceeding with test 3.0. Position 977A-1 MODE switch to ILS.							
110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Check 211-A PERCENT MODULATION meter for 20 percent. Adjust 211-A MOD LEVEL control if necessary. Position 479S-3 TONE LOCALIZER switch to CAL 90 ∿. 211-A PERCENT MODULATION meter should indicate 20 percent.							
	Observe meter.	VL DEV PRI			DC VM	HP-425A (FUNCTION switch to VOLTAGE unless otherwise specified)	90 ua to the right	If necessary, adjust PRI SENS control (VOR/LOC instrumentation Z1R201) until result is obtained.
	Observe meter.	VL DEV SEC			DC VM	HP-425A	90 ua to the right	If necessary, adjust SEC SENS control (VOR/LOC instrumentation Z1R221) until result is obtained.
	Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (VOR/LOC instrumentation Z1R257) until result is obtained.
	Observe meter.	VL DEV SEC			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.2.0	VOR/LOC sensor			TONE LOCALIZER switch to 4DB (to the right).		Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) clockwise until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes o
						Observe meter and record indication.	Test connector adapter unit J7 and grd	HP-410B	Recorded
		Per figure 703	XTAL switch to 110.1 MOD switch to EXT	TONE LOCALIZER switch to 4DB (to the right).	110.10 MHz				
3.2.1						Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) counterclockwise until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes o
						Observe meter and record indication.	Test connector adapter unit J7 and grd	HP-410B	Recorded
3.2.2						Observe meter and adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) to center of voltage range obtained in tests 3.2.0 and 3.2.1 (use voltages of tests 3.2.0 and 3.2.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 3.2.0 or 3.2.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	Test connector adapter unit J7 and grd	HP-410B	Adjusted to cente of voltage range
3.2.3				TONE LOCALIZER switch to 0		Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes o
						NOTE: HP-425A should be floating for this test			
						Insert phone plug into test jig J7, and observe meter (connected between test points).	Tip of phone plug and test connector adapter unit J14	HP-425A	5 ±0.5 ua
3.2.4						Adjust GATE WID control (VOR/LOC instrumentation Z2R38) until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes o
						Remove phone plug installed in test 3.2.3.			
						Observe meter.	Test connector adapter unit J14 and J15	HP-425A	0 ua (centered)
3.2.5						Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 4.C.(1) and 4.C.(2)).			
						Observe meter and record db indication and vac indication	211-A modulation jacks	Ballantine 310A	Recorded

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Complete all parts of tests 1.0 and 2.0 before proceeding with test 3.0. Position 977A-1 MODE switch to ILS.							
110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter. Check 211-A PERCENT MODULATION meter for 20 percent. Adjust 211-A MOD LEVEL control if necessary. Position 479S-3 TONE LOCALIZER switch to CAL 90 ~. 211-A PERCENT MODULATION meter should indicate 20 percent.							
	Observe meter.	VL DEV PRI			DC VM	HP-425A (FUNCTION switch to VOLTAGE unless otherwise specified)	90 ua to the right	If necessary, adjust PRI SENS control (VOR/LOC instrumentation Z1R201) until result is obtained.
	Observe meter.	VL DEV SEC			DC VM	HP-425A	90 ua to the right	If necessary, adjust SEC SENS control (VOR/LOC instrumentation Z1R221) until result is obtained.
	Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (VOR/LOC instrumentation Z1R257) until result is obtained.
	Observe meter.	VL DEV SEC			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.2.0	VOR/LOC sensor			TONE LOCALIZER switch to 4DB (to the right).		Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) clockwise until result is obtained. Observe meter and record indication.	Test jig HI POWER VOR/LOC FLAG light Test connector adapter unit J7 and grd	 HP-410B	Light just goes off Recorded		Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) clockwise until result is obtained. Observe meter and record indication	 VL LOGIC DET			VL POWER FLAG light DC VM	 HP-410B	Light just goes off Recorded	NOTE: VOR/LOC instrumentation controls Z2R40 (LOGIC DET), Z2R38 (GATE WID) and Z2R70 (FLAG THRESHOLD) are accessible from three holes on top of the dust cover. Viewing the 51RV-2B from the front, the LOGIC DET control is under the center hole, GATE WID is under the right hand hole, and FLAG THRESHOLD is under the left hole.
		Per figure 703	XTAL switch to 110.1 MOD switch to EXT	TONE LOCALIZER switch to 4DB (to the right).	110.10 MHz					110.10 MHz		VL LOGIC DET	VL AF	VL AF				
3.2.1						Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) counterclockwise until result is obtained. Observe meter and record indication.	Test jig HI POWER VOR/LOC FLAG light Test connector adapter unit J7 and grd	 HP-410B	Light just goes off Recorded		Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) counterclockwise until result is obtained. Observe meter and record indication.	 VL LOGIC DET			VL POWER FLAG light DC VM	 HP-410B	Light just goes off Recorded	
3.2.2						Observe meter and adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) to center of voltage range obtained in tests 3.2.0 and 3.2.1 (use voltages of tests 3.2.0 and 3.2.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 3.2.0 or 3.2.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	Test connector adapter unit J7 and grd	HP-410B	Adjusted to center of voltage range		Observe meter and adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) to center of voltage range obtained in tests 3.2.0 and 3.2.1 (use voltages of tests 3.2.0 and 3.2.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 3.2.0 or 3.2.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	VL LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
3.2.3				TONE LOCALIZER switch to 0		Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained. NOTE: HP-425A should be floating for this test Insert phone plug into test jig J7, and observe meter (connected between test points).	Test jig HI POWER VOR/LOC FLAG light Tip of phone plug and test connector adapter unit J14	 HP-425A	Light just goes off 5 ±0.5 ua		Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter.	 VL DEV DIF			VL POWER FLAG light DC VM	 HP-425A (FUNCTION switch to CURRENT unless otherwise specified)	Light just goes off 5 ±0.5 ua	If necessary, readjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
3.2.4						Adjust GATE WID control (VOR/LOC instrumentation Z2R38) until result is obtained. Remove phone plug installed in test 3.2.3. Observe meter.	Test jig HI POWER VOR/LOC FLAG light Test connector adapter unit J14 and J15	 HP-425A	Light just goes off 0 ua (centered)		Adjust GATE WID control (VOR/LOC instrumentation Z2R38) until result is obtained. Observe meter.	 VL DEV SEC			VL POWER FLAG light DC VM	 HP-425A	Light just goes off 0 ua (centered)	Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
3.2.5						Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 4.C.(1) and 4.C.(2)). Observe meter and record db indication and vac indication	211-A modulation jacks	Ballantine 310A	Recorded		Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 4.C.(1) and 4.C.(2)). Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	NOTE: VOR/LOC instrumentation controls Z2R40 (LOGIC DET), Z2R38 (GATE WID) and Z2R70 (FLAG THRESHOLD) are accessible from three holes on top of the dust cover. Viewing the 51RV-2B from the front, the LOGIC DET control is under the center hole, GATE WID is under the right hand hole, and FLAG THRESHOLD is under the left hole.
	Observe meter and record indication	VL LOGIC DET			DC VM	HP-410B	Recorded	
110.10 MHz		VL LOGIC DET	VL AF	VL AF				
	Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) counterclockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication.	VL LOGIC DET			DC VM	HP-410B	Recorded	
	Observe meter and adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) to center of voltage range obtained in tests 3.2.0 and 3.2.1 (use voltages of tests 3.2.0 and 3.2.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 3.2.0 or 3.2.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	VL LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
	Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained. NOTE: HP-425A should be floating for this test.				VL POWER FLAG light		Light just goes off	
	Observe meter.	VL DEV DIF			DC VM	HP-425A (FUNCTION switch to CURRENT unless otherwise specified)	5 ±0.5 ua	If necessary, readjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
	Adjust GATE WID control (VOR/LOC instrumentation Z2R38) until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter.	VL DEV SEC			DC VM	HP-425A	0 ua (centered)	Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
	Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 4.C.(1) and 4.C.(2)). Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.2.6			Adjust MOD LEVEL control per procedure			Observe meter and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.5
3.2.7			Adjust MOD LEVEL control per procedure			CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe HI POWER VOR/LOC FLAG light on test jig. If light is off, adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) clockwise approximately 8 turns. HI POWER VOR/LOC FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.	Test jig HI POWER VOR/LOC FLAG light		Light just goes off
3.2.8			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.5. Observe indicator.	Test jig HI POWER VOR/LOC FLAG light		Light is on
3.2.9						Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded
3.2.10			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.9

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	NOTE: VOR/LOC instrumentation controls Z2R40 (LOGIC DET), Z2R38 (GATE WID) and Z2R70 (FLAG THRESHOLD) are accessible from three holes on top of the dust cover. Viewing the 51RV-2B from the front, the LOGIC DET control is under the center hole, GATE WID is under the right hand hole, and FLAG THRESHOLD is under the left hole.
	Observe meter and record indication	VL LOGIC DET			DC VM	HP-410B	Recorded	
110.10 MHz		VL LOGIC DET	VL AF	VL AF				
	Adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) counterclockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication.	VL LOGIC DET			DC VM	HP-410B	Recorded	
	Observe meter and adjust LOGIC DET control (VOR/LOC instrumentation Z2R40) to center of voltage range obtained in tests 3.2.0 and 3.2.1 (use voltages of tests 3.2.0 and 3.2.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 3.2.0 or 3.2.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	VL LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
	Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained. NOTE: HP-425A should be floating for this test.				VL POWER FLAG light		Light just goes off	
	Observe meter.	VL DEV DIF			DC VM	HP-425A (FUNCTION switch to CURRENT unless otherwise specified)	5 ±0.5 ua	If necessary, readjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
	Adjust GATE WID control (VOR/LOC instrumentation Z2R38) until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter.	VL DEV SEC			DC VM	HP-425A	0 ua (centered)	Adjust SEC CTR control (VOR/LOC instrumentation Z1R260) until result is obtained.
	Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 4.C.(1) and 4.C.(2)).							
	Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.2.6			Adjust MOD LEVEL control per procedure			Observe meter and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.5		Observe meter and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.5	
3.2.7			Adjust MOD LEVEL control per procedure			CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe HI POWER VOR/LOC FLAG light on test jig. If light is off, adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) clockwise approximately 8 turns. HI POWER VOR/LOC FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.	Test jig HI POWER VOR/LOC FLAG light		Light just goes off		CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe VL POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) clockwise approximately 8 turns. VL POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.				VL POWER FLAG light		Light just goes off	
3.2.8			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.5. Observe indicator.	Test jig HI POWER VOR/LOC FLAG light		Light is on		Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.5. Observe indicator.				VL POWER FLAG light		Light is on	
3.2.9						Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded		Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	
3.2.10			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.9		Adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	Recorded	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.5	
	CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe VL POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) clockwise approximately 8 turns. VL POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.				VL POWER FLAG light		Light just goes off	
	Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.5. Observe indicator.				VL POWER FLAG light		Light is on	
	Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	
	Adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.2.11						Observe indicator. If necessary, repeat tests 3.2.7 through 3.2.11 until result is obtained (see note in COMMENTS column).	Test jig HI POWER VOR/LOC FLAG light		Light is off
3.2.12			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.9.			

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	2 db less than db indication recorded in test 3.2.5	
	CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe VL POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) clockwise approximately 8 turns. VL POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (VOR/LOC instrumentation Z2R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.				VL POWER FLAG light		Light just goes off	
	Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.5. Observe indicator.				VL POWER FLAG light		Light is on	
	Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded	
	Adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				211-A modulation jacks	Ballantine 310A	Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.2.11						Observe indicator. If necessary, repeat tests 3.2.7 through 3.2.11 until result is obtained (see note in COMMENTS column).	Test jig HI POWER VOR/LOC FLAG light		Light is off		Observe indicator. If necessary, repeat tests 3.2.7 through 3.2.11 until result is obtained (see note in COMMENTS column).				VL POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 3.2.9).
3.2.12			Adjust MOD LEVEL control per procedure			Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.9.					Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.9.							

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe indicator. If necessary, repeat tests 3.2.7 through 3.2.11 until result is obtained (see note in COMMENTS column).				VL POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 3.2.9).
	Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.9.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.3.0	RMI pointer bias					Observe pointer.	Test jig	RMI	90 ±2.0 degre (right wing position)

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe indicator. If necessary, repeat tests 3.2.7 through 3.2.11 until result is obtained (see note in COMMENTS column).				VL POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 3.2.9).
	Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 3.2.9.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.3.0	RMI pointer bias					Observe pointer.	Test jig	RMI	90 ±2.0 degrees (right wing position)		Observe pointer.					RMI	90 ±2.0 degrees (right wing position)	

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	PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
	FREQUENCY	PROCEDURE	OUTPUT						
			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
s		Observe pointer.					RMI	90 ±2.0 degrees (right wing position)	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.4.0	Localizer flag current					Observe meter.	Test jig J8	HP-425A	420 to 510 us

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	PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
	FREQUENCY	PROCEDURE	OUTPUT						
			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
s		Observe pointer.					RMI	90 ±2.0 degrees (right wing position)	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-() CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.4.0	Localizer flag current					Observe meter.	Test jig J8	HP-425A	420 to 510 ua		Observe meter.	VL FLAG			DC VM	HP-425A	420 to 510 ua	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	VL FLAG			DC VM	HP-425A	420 to 510 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.5.0	VOR zero, tracking, balance, and sensitivity		XTAL switch to 114.9 Adjust FREQUENCY control per procedure	FUNCTION SELECTOR switch to ODR	114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter.			
3.5.1						NOTE: HP-425A should be floating for this test. Observe meter.	Test jig J7	HP-425A	0 ua (centered)
3.5.2				PHASE ANGLE SELECTOR to 10 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	Indication (in ua is same on both meters
3.5.3						Observe meter.	Test jig J7	HP-425A	150 ±3 ua
3.5.4				PHASE ANGLE SELECTOR to 90 degrees		Position 479V-3 BEARING DEGREES switch to 270 degrees. Observe meter.	Test jig J7	HP-425A	0 ua (centered)
3.5.5				PHASE ANGLE SELECTOR to 0		Position 479V-3 BEARING DEGREES switch to 180 degrees. Observe meter.	Test jig J7	HP-425A	0 ua (centered)
3.5.6				Adjust PHASE ANGLE SELECTOR per procedure		Remove 400-Hz power from test jig. Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indications.	Test connector adapter unit J16 and grd Test connector adapter unit J17 and J18	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded
		Per figure 703.	XTAL switch to 114.9	PHASE ANGLE SELECTOR adjusted per procedure	114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.			
3.5.7				Adjust PHASE ANGLE SELECTOR per procedure		Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	Test connector adapter unit J16 and grd Test connector adapter unit J17 and J18	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	VL FLAG			DC VM	HP-425A	420 to 510 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL									COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT							
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.5.0	VOR zero, tracking, balance, and sensitivity		XTAL switch to 114.9 Adjust FREQUENCY control per procedure	FUNCTION SELECTOR switch to ODR	114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF MONITOR meter.				114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF.							
3.5.1						NOTE: HP-425A should be floating for this test. Observe meter.	Test jig J7	HP-425A	0 ua (centered)		NOTE: HP-425A should be floating for this test. Position 977A-1 MODE switch to VOR. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
3.5.2				PHASE ANGLE SELECTOR to 10 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	Indication (in ua) is same on both meters		Observe meter for each switch position.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	Indication (in ua) is same on both meters	If necessary, adjust VOR BAL control (VOR/LOC instrumentation Z1R245) until result is obtained.
3.5.3						Observe meter.	Test jig J7	HP-425A	150 ±3 ua		Observe meter.	VL DEV PRI			DC VM	HP-425A	150 ±3 ua	If necessary, adjust VOR SENS control (VOR/LOC instrumentation Z1R252) until result is obtained.
3.5.4				PHASE ANGLE SELECTOR to 90 degrees		Position 479V-3 BEARING DEGREES switch to 270 degrees. Observe meter.	Test jig J7	HP-425A	0 ua (centered)		Position 479V-3 BEARING DEGREES switch to 270 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI TRACK control (VOR/LOC instrumentation Z1R166) until result is obtained.
3.5.5				PHASE ANGLE SELECTOR to 0		Position 479V-3 BEARING DEGREES switch to 180 degrees. Observe meter.	Test jig J7	HP-425A	0 ua (centered)		Position 479V-3 BEARING DEGREES switch to 180 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
3.5.6				Adjust PHASE ANGLE SELECTOR per procedure		Remove 400-Hz power from test jig. Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indications.	Test connector adapter unit J16 and grd Test connector adapter unit J17 and J18	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded		Position AC INPUT POWER switch off (down). Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	 MON DET		 MON LOGIC	 CRO DC VM	 Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	 2-kHz waveform disappears Recorded	
		Per figure 703.	XTAL switch to 114.9	PHASE ANGLE SELECTOR adjusted per procedure	114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.				114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	MON DET	VL AF	MON LOGIC				
3.5.7				Adjust PHASE ANGLE SELECTOR per procedure		Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	Test connector adapter unit J16 and grd Test connector adapter unit J17 and J18	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded		Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	 MON DET		 MON LOGIC	 CRO DC VM	 Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	 2-kHz waveform disappears Recorded	

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF.							
	NOTE: HP-425A should be floating for this test. Position 977A-1 MODE switch to VOR. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
	Observe meter for each switch position.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	Indication (in ua) is same on both meters	If necessary, adjust VOR BAL control (VOR/LOC instrumentation Z1R245) until result is obtained.
	Observe meter.	VL DEV PRI			DC VM	HP-425A	150 ±3 ua	If necessary, adjust VOR SENS control (VOR/LOC instrumentation Z1R252) until result is obtained.
	Position 479V-3 BEARING DEGREES switch to 270 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI TRACK control (VOR/LOC instrumentation Z1R166) until result is obtained.
	Position 479V-3 BEARING DEGREES switch to 180 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
	Position AC INPUT POWER switch off (down). Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	MON DET		MON LOGIC	CRO DC VM	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded	
114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	MON DET	VL AF	MON LOGIC				
	Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	MON DET		MON LOGIC	CRO DC VM	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479B-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.5.8				PHASE ANGLE SELECTOR to 0 degree		Reapply 400-Hz power to test jig. Observe meter and adjust MON ZERO control (VOR/LOC instrumentation Z1R134) to center of voltage range obtained in tests 3.5.6 and 3.5.7 (use voltages of tests 3.5.6 and 3.5.7 as end limit voltage range). EXAMPLE: If voltage indication in test 3.5.6 were +32 mv (as indicated on HP-425A), and voltage indication in test 3.5.7 were -14 mv, the MON ZERO control would be adjusted for the center of the range, or in this example, +9 mv (see COMMENTS column).	Test connector adapter unit J17 and J18	HP-425A (FUNCTION switch to VOLTAGE)	Adjusted to center ± 0.5 mv of voltage range, but shall not be greater than 10 mv. Record center indication in mv
3.5.9				PHASE ANGLE SELECTOR to 90 degrees		Adjust 479V-3 BEARING DEGREES switch to 270 degrees. NOTE: HP-425A should be floating for this test. Observe meter.	Test connector adapter unit J17 and J18	HP-425A (FUNCTION switch to VOLTAGE)	Center voltage figure recorded in test 3.5.8 (±0.5 mv tolerance)

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red-line indication on RF.							
	NOTE: HP-425A should be floating for this test. Position 977A-1 MODE switch to VOR. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
	Observe meter for each switch position.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	Indication (in ua) is same on both meters	If necessary, adjust VOR BAL control (VOR/LOC instrumentation Z1R245) until result is obtained.
	Observe meter.	VL DEV PRI			DC VM	HP-425A	150 ±3 ua	If necessary, adjust VOR SENS control (VOR/LOC instrumentation Z1R252) until result is obtained.
	Position 479V-3 BEARING DEGREES switch to 270 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI TRACK control (VOR/LOC instrumentation Z1R166) until result is obtained.
	Position 479V-3 BEARING DEGREES switch to 180 degrees. Observe meter.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI ZERO control (VOR/LOC instrumentation Z1R14) until result is obtained.
	Position AC INPUT POWER switch off (down). Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	MON DET		MON LOGIC	CRO DC VM	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded	
114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	MON DET	VL AF	MON LOGIC				
	Observe oscilloscope and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter and record mv indication.	MON DET		MON LOGIC	CRO DC VM	Oscilloscope HP-425A (FUNCTION switch to VOLTAGE)	2-kHz waveform disappears Recorded	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479B-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.5.8				PHASE ANGLE SELECTOR to 0 degree		Reapply 400-Hz power to test jig. Observe meter and adjust MON ZERO control (VOR/LOC instrumentation Z1R134) to center of voltage range obtained in tests 3.5.6 and 3.5.7 (use voltages of tests 3.5.6 and 3.5.7 as end limit voltage range). EXAMPLE: If voltage indication in test 3.5.6 were +32 mv (as indicated on HP-425A), and voltage indication in test 3.5.7 were -14 mv, the MON ZERO control would be adjusted for the center of the range, or in this example, +9 mv (see COMMENTS column).	Test connector adapter unit J17 and J18	HP-425A (FUNCTION switch to VOLTAGE)	Adjusted to center ± 0.5 mv of voltage range, but shall not be greater than 10 mv. Record center indication in mv.		Position AC INPUT POWER switch on. Observe meter and adjust MON ZERO control (VOR/LOC instrumentation Z1R134) to center of voltage range obtained in tests 3.5.6 and 3.5.7 (use voltages of tests 3.5.6 and 3.5.7 as end limit voltage range). EXAMPLE: If voltage indication in test 3.5.6 were +32 mv (as indicated on HP-425A), and voltage indication in test 3.5.7 were -14 mv, the MON ZERO control would be adjusted for the center of the range, or in this example, +9 mv (see COMMENTS column).	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Adjusted to center ±0.5 mv of voltage range, but shall be not greater than 10 mv Record center indication in mv	The center range obtained in the EXAMPLE shown in the PROCEDURE column was derived as follows: The total voltage range (in mv) was 32 mv to the right of 0 (on the HP-425A) and 14 mv to the left of 0. This gives a total voltage range of 46 mv (32 + 14 = 46). Half of the total is therefore 23 mv (46 ÷ 2 = 23). This 23 mv is the center of the total voltage range. However, the HP-425A has a 0 center scale, so to determine where the center of the total voltage range actually occurs on the meter scale, take the highest indication (32 mv) and subtract from that the center of the total voltage range (23 mv) which gives 9 mv, the center of the voltage range as indicated on the HP-425A scale.
3.5.9				PHASE ANGLE SELECTOR to 90 degrees		Adjust 479V-3 BEARING DEGREES switch to 270 degrees. NOTE: HP-425A should be floating for this test. Observe meter.	Test connector adapter unit J17 and J18	HP-425A (FUNCTION switch to VOLTAGE)	Center voltage figure recorded in test 3.5.8 (±0.5 mv tolerance)		Adjust 479V-3 BEARING DEGREES switch to 270 degrees. NOTE: HP-425A should be floating for this test. Observe meter.	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Center voltage figure recorded in test 3.5.8 (±0.5 mv tolerance)	If necessary, adjust MON TRACK control (VOR/LOC instrumentation Z1R186) until result is obtained.

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position AC INPUT POWER switch on. Observe meter and adjust MON ZERO control (VOR/LOC instrumentation Z1R134) to center of voltage range obtained in tests 3.5.6 and 3.5.7 (use voltages of tests 3.5.6 and 3.5.7 as end limit voltage range). EXAMPLE: If voltage indication in test 3.5.6 were +32 mv (as indicated on HP-425A), and voltage indication in test 3.5.7 were -14 mv, the MON ZERO control would be adjusted for the center of the range, or in this example, +9 mv (see COMMENTS column).	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Adjusted to center ±0.5 mv of voltage range, but shall be not greater than 10 mv Record center indication in mv	The center range obtained in the EXAMPLE shown in the PROCEDURE column was derived as follows: The total voltage range (in mv) was 32 mv to the right of 0 (on the HP-425A) and 14 mv to the left of 0. This gives a total voltage range of 46 mv (32 + 14 = 46). Half of the total is therefore 23 mv (46 ÷ 2 = 23). This 23 mv is the center of the total voltage range. However, the HP-425A has a 0 center scale, so to determine where the center of the total voltage range actually occurs on the meter scale, take the highest indication (32 mv) and subtract from that the center of the total voltage range (23 mv) which gives 9 mv, the center of the voltage range as indicated on the HP-425A scale.
	Adjust 479V-3 BEARING DEGREES switch to 270 degrees. NOTE: HP-425A should be floating for this test. Observe meter.	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Center voltage figure recorded in test 3.5.8 (±0.5 mv tolerance)	If necessary, adjust MON TRACK control (VOR/LOC instrumentation Z1R186) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.6.0	Automatic VOR					Adjust 479V-3 BEARING DEGREES switch to 90 degrees and let RMI stabilize.			
3.6.1				Adjust PHASE ANGLE SELECTOR per procedure		Remove 400-Hz power from test jig. Adjust 479S-3 PHASE ANGLE SELECTOR to 120 degrees. Reapply 400-Hz power and observe RMI pointer.		RMI pointer	RMI makes one overshoot

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position AC INPUT POWER switch on. Observe meter and adjust MON ZERO control (VOR/LOC instrumentation Z1R134) to center of voltage range obtained in tests 3.5.6 and 3.5.7 (use voltages of tests 3.5.6 and 3.5.7 as end limit voltage range). EXAMPLE: If voltage indication in test 3.5.6 were +32 mv (as indicated on HP-425A), and voltage indication in test 3.5.7 were -14 mv, the MON ZERO control would be adjusted for the center of the range, or in this example, +9 mv (see COMMENTS column).	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Adjusted to center ±0.5 mv of voltage range, but shall be not greater than 10 mv Record center indication in mv	The center range obtained in the EXAMPLE shown in the PROCEDURE column was derived as follows: The total voltage range (in mv) was 32 mv to the right of 0 (on the HP-425A) and 14 mv to the left of 0. This gives a total voltage range of 46 mv (32 + 14 = 46). Half of the total is therefore 23 mv (46 ÷ 2 = 23). This 23 mv is the center of the total voltage range. However, the HP-425A has a 0 center scale, so to determine where the center of the total voltage range actually occurs on the meter scale, take the highest indication (32 mv) and subtract from that the center of the total voltage range (23 mv) which gives 9 mv, the center of the voltage range as indicated on the HP-425A scale.
	Adjust 479V-3 BEARING DEGREES switch to 270 degrees. NOTE: HP-425A should be floating for this test. Observe meter.	MON DET			DC VM	HP-425A (FUNCTION switch to VOLTAGE)	Center voltage figure recorded in test 3.5.8 (±0.5 mv tolerance)	If necessary, adjust MON TRACK control (VOR/LOC instrumentation Z1R186) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.6.0	Automatic VOR					Adjust 479V-3 BEARING DEGREES switch to 90 degrees and let RMI stabilize.					Adjust 479V-3 BEARING DEGREES switch to 90 degrees and let RMI stabilize.							
3.6.1				Adjust PHASE ANGLE SELECTOR per procedure		Remove 400-Hz power from test jig. Adjust 479S-3 PHASE ANGLE SELECTOR to 120 degrees. Reapply 400-Hz power and observe RMI pointer.		RMI pointer	RMI makes one overshoot		Position AC INPUT POWER switch off. Adjust 479S-3 PHASE ANGLE SELECTOR to 120 degrees. Position AC INPUT POWER switch on and observe RMI pointer.					RMI pointer	RMI makes one overshoot	If necessary, adjust RATE control (VOR/LOC instrumentation Z1R310) to obtain one overshoot of RMI pointer when an abrupt change is made.

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust 479V-3 BEARING DEGREES switch to 90 degrees and let RMI stabilize.							
	Position AC INPUT POWER switch off. Adjust 479S-3 PHASE ANGLE SELECTOR to 120 degrees. Position AC INPUT POWER switch on and observe RMI pointer.					RMI pointer	RMI makes one overshoot	If necessary, adjust RATE control (VOR/LOC instrumentation Z1R310) to obtain one overshoot of RMI pointer when an abrupt change is made.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.7.0	On course gate width (VOR)			PHASE ANGLE SELECTOR to 0 degree, then adjust per procedure		Adjust 479V-3 BEARING DEGREES switch to 180 degrees. Install jumper between test connector adapter unit jacks J14 and J15. Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. Observe meter and record indication.	Test jig H1 POWER VOR/LOC FLAG light Test jig J7	HP-425A (FUNCTION switch to CURRENT)	Light just goes off Recorded
3.7.1				Adjust PHASE ANGLE SELECTOR per procedure		Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. Observe meter and record indication.	Test jig H1 POWER VOR/LOC FLAG light Test jig J7	HP-425A	Light just goes off Recorded
3.7.2						Determine total on course gate width by adding results (in ua) obtained in tests 3.7.0 and 3.7.1.		HP-425A	36 ±5 ua

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust 479V-3 BEARING DEGREES switch to 90 degrees and let RMI stabilize.							
	Position AC INPUT POWER switch off. Adjust 479S-3 PHASE ANGLE SELECTOR to 120 degrees. Position AC INPUT POWER switch on and observe RMI pointer.					RMI pointer	RMI makes one overshoot	If necessary, adjust RATE control (VOR/LOC instrumentation Z1R310) to obtain one overshoot of RMI pointer when an abrupt change is made.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.7.0	On course gate width (VOR)			PHASE ANGLE SELECTOR to 0 degree, then adjust per procedure		Adjust 479V-3 BEARING DEGREES switch to 180 degrees. Install jumper between test connector adapter unit jacks J14 and J15. Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. Observe meter and record indication.	 Test jig H1 POWER VOR/LOC FLAG light Test jig J7	 HP-425A (FUNCTION switch to CURRENT)	 Light just goes off Recorded		Adjust 479V-3 BEARING DEGREES switch to 180 degrees. Position DC VOLTAGE switch S3 to VL DEV DIF. Install a jumper between black ALT DC VM jack and the VL DEV LOAD C (common) jack. Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR counterclockwise until result is obtained. Observe meter and record indication	 VL DEV DIF	 	 	 VL POWER FLAG light DC VM	 HP-425A (FUNCTION switch to CURRENT)	 Light just goes off Recorded	
3.7.1				Adjust PHASE ANGLE SELECTOR per procedure		Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. Observe meter and record indication.	Test jig H1 POWER VOR/LOC FLAG light Test jig J7	 HP-425A	Light just goes off Recorded		Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained. Observe meter and record indication.	 VL DEV DIF	 	 	VL POWER FLAG light DC VM	 HP-425A	Light just goes off Recorded	
3.7.2						Determine total on course gate width by adding results (in ua) obtained in tests 3.7.0 and 3.7.1.		HP-425A	36 ±5 ua		Determine total on course gate width by adding results (in ua) obtained in tests 3.7.0 and 3.7.1.					HP-425A	36 ±5 ua	

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust 479V-3 BEARING DEGREES switch to 180 degrees.							
	Position DC VOLTAGE switch S3 to VL DEV DIF. Install a jumper between black ALT DC VM jack and the VL DEV LOAD C (common) jack.							
	Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR counter-clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication	VL DEV DIF			DC VM	HP-425A (FUNCTION switch to CURRENT)	Recorded	
	Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication.	VL DEV DIF			DC VM	HP-425A	Recorded	
	Determine total on course gate width by adding results (in ua) obtained in tests 3.7.0 and 3.7.1.					HP-425A	36 ±5 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
3.8.0	Off course gate width (VOR)			PHASE ANGLE SELECTOR to 40 degrees		Remove jumper between test connector adapter unit jacks J14 and J15. Connect resistance decade box between test connector adapter unit jacks J14 and J15. Adjust decade box for 5000 ohms.			
3.8.1						Observe indicator and adjust resistance decade box (decreasing resistance) until result is obtained. Install a phone plug into test jig J17. NOTE: HP-425A should be floating for this test. Observe meter.	Test jig H1 POWER VOR/LOC FLAG light. Tip of phone plug and test connector adapter unit J14.	 HP-425A	Light just goes off. 90 ±20 ua
3.8.2						Remove resistance decade box. Remove phone plug from test jig J17.			

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust 479V-3 BEARING DEGREES switch to 180 degrees.							
	Position DC VOLTAGE switch S3 to VL DEV DIF. Install a jumper between black ALT DC VM jack and the VL DEV LOAD C (common) jack.							
	Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR counter-clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication	VL DEV DIF			DC VM	HP-425A (FUNCTION switch to CURRENT)	Recorded	
	Observe indicator and adjust 479S-3 PHASE ANGLE SELECTOR clockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter and record indication.	VL DEV DIF			DC VM	HP-425A	Recorded	
	Determine total on course gate width by adding results (in ua) obtained in tests 3.7.0 and 3.7.1.					HP-425A	36 ±5 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
3.S.0	Off course gate width (VOR)			PHASE ANGLE SELECTOR to 40 degrees		Remove jumper between test connector adapter unit jacks J14 and J15. Connect resistance decade box between test connector adapter unit jacks J14 and J15. Adjust decade box for 5000 ohms.					Remove jumper between black ALT DC VM jack and VL DEV LOAD C jack. Connect resistance decade box between black ALT DC VM jack and the VL DEV LOAD C (common) jack. Adjust decade box for 5000 ohms.							
3.S.1						Observe indicator and adjust resistance decade box (decreasing resistance) until result is obtained. Install a phone plug into test jig J17. NOTE: HP-425A should be floating for this test. Observe meter.	Test jig H1 POWER VOR/LOC FLAG light. Tip of phone plug and test connector adapter unit J14.	 HP-425A	Light just goes off. 90 ±20 ua		Observe indicator and adjust resistance decade box (decreasing resistance) until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter.	 VL DEV DIF			VL POWER FLAG light DC VM	 HP-425A	Light just goes off 90 ±20 ua	
3.S.2						Remove resistance decade box. Remove phone plug from test jig J17.					Remove resistance decade box.							

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Remove jumper between black ALT DC VM jack and VL DEV LOAD C jack. Connect resistance decade box between black ALT DC VM jack and the VL DEV LOAD C (common) jack. Adjust decade box for 5000 ohms.							
	Observe indicator and adjust resistance decade box (decreasing resistance) until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter.	VL DEV DIF			VL POWER FLAG light DC VM	HP-425A	Light just goes off. 90 ±20 ua	
	Remove resistance decade box.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
		Per figure 703	XTAL switch to 114.9	PHASE ANGLE SELECTOR to 40 degrees	114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.			
3.9.0	VOR deviation linearity			PHASE ANGLE SELECTOR to 0 degree		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	0 ±1.2 ua at each test point
3.9.1				PHASE ANGLE SELECTOR to 10 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	150 ±3 ua at each test point
3.9.2				PHASE ANGLE SELECTOR to 60 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	748 ±40 ua at each test point
3.9.3				PHASE ANGLE SELECTOR to 90 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	865 ±45 ua at each test point
3.9.4				PHASE ANGLE SELECTOR to 120 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	748 ±40 ua at each test point
3.9.5				PHASE ANGLE SELECTOR to 180 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	0 ±4 ua at each test point
3.9.6				PHASE ANGLE SELECTOR to 270 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	865 ±45 ua at each test point

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Remove jumper between black ALT DC VM jack and VL DEV LOAD C jack. Connect resistance decade box between black ALT DC VM jack and the VL DEV LOAD C (common) jack. Adjust decade box for 5000 ohms.							
	Observe indicator and adjust resistance decade box (decreasing resistance) until result is obtained. NOTE: HP-425A should be floating for this test. Observe meter.	VL DEV DIF			VL POWER FLAG light DC VM	HP-425A	Light just goes off 90 ±20 ua	
	Remove resistance decade box.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL									COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT							
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT		
		Per figure 703	XTAL switch to 114.9	PHASE ANGLE SELECTOR to 40 degrees	114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.				114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	VL DEV DIF	VL AF	MON LOGIC					
3.9.0	VOR deviation linearity			PHASE ANGLE SELECTOR to 0 degree		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	0 ±1.2 ua at each test point		Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	0 ±1.2 ua 0 ±1.2 ua		
3.9.1				PHASE ANGLE SELECTOR to 10 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	150 ±3 ua at each test point		Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	150 ±3 ua 150 ±3 ua		
3.9.2				PHASE ANGLE SELECTOR to 60 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	748 ±40 ua at each test point		Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua		
3.9.3				PHASE ANGLE SELECTOR to 90 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	865 ±45 ua at each test point		Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua		
3.9.4				PHASE ANGLE SELECTOR to 120 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	748 ±40 ua at each test point		Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua		
3.9.5				PHASE ANGLE SELECTOR to 180 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	0 ±4 ua at each test point		Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	0 ±4 ua 0 ±4 ua		
3.9.6				PHASE ANGLE SELECTOR to 270 degrees		Observe meters.	Test jig J7 and test connector adapter unit J14 and J15	HP-425A (2 reqd)	865 ±45 ua at each test point		Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua		

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	VL DEV DIF	VL AF	MON LOGIC				
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	0 ±1.2 ua 0 ±1.2 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	150 ±3 ua 150 ±3 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	0 ±4 ua 0 ±4 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.10.0	Automatic VOR gate level			PHASE ANGLE SELECTOR to 0 degree		Observe meter and record db indication.	Test connector adapter unit J13 and grd	Ballantine 310A	Recorded
3.10.1			Adjust MOD LEVEL control per procedure			Observe indicator and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes off
						Observe meter.	Test connector adapter unit J13 and grd	Ballantine 310A	4 ±1.0 db less than db indication recorded in test 3.10.0

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
114.90 MHz	479V-3 BEARING DEGREES switch to 180 degrees.	VL DEV DIF	VL AF	MON LOGIC				
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	0 ±1.2 ua 0 ±1.2 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	150 ±3 ua 150 ±3 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	748 ±40 ua 748 ±40 ua	
	Observe meter.	VL DEV SEC VL DEV PRI			DC VM DC VM	HP-425A HP-425A	0 ±4 ua 0 ±4 ua	
	Observe meter.	VL DEV PRI VL DEV SEC			DC VM DC VM	HP-425A HP-425A	865 ±45 ua 865 ±45 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.10.0	Automatic VOR gate level			PHASE ANGLE SELECTOR to 0 degree		Observe meter and record db indication.	Test connector adapter unit J13 and grd	Ballantine 310A	Recorded		Observe meter and record db indication.		VHF DET AF		AC VM	Ballantine 310A	Recorded	
3.10.1			Adjust MOD LEVEL control per procedure			Observe indicator and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.	Test jig HI POWER VOR/LOC FLAG light		Light just goes off		Observe indicator and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
						Observe meter.	Test connector adapter unit J13 and grd	Ballantine 310A	4 ±1.0 db less than db indication recorded in test 3.10.0		Observe meter.		VHF DET AF		AC VM	Ballantine 310A	4 ±1.0 db less than db indication recorded in test 3.10.0.	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter and record db indication.		VHF DET AF		AC VM	Ballantine 310A	Recorded	
	Observe indicator and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter.		VHF DET AF		AC VM	Ballantine 310A	4 ±1.0 db less than db indication recorded in test 3.10.0.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.0	951A-1 Glideslope Receiver Tests								
4.1.0	Glideslope Sensitivity	Adjust OUTPUT LEVEL control per procedure	XTAL switch to 110.1. Adjust FREQUENCY control around 110.10 for red-line indication on RF MONITOR meter	FUNCTION SELECTOR to TONE LOC	110.10 MHz	Observe meter and adjust 232-A OUTPUT LEVEL control counter-clockwise until result is obtained. Observe dial indication.	Test jig J5 OUTPUT LEVEL dial	HP-425A 232-A	47 ua Less than 10 ua
4.1.1		Adjust OUTPUT LEVEL control to 10 uv. In turn, adjust FREQUENCY switch to: 334.70 MHz 334.10 MHz 330.50 MHz 335.00 MHz 330.80 MHz 331.10 MHz (corresponds to 313N-( ) or 977A-1 frequencies in the order shown)			108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Observe meter for each pair of listed frequencies. Readjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter for each frequency change.	Test jig J5	HP-425A	Not less than 47 ua

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter and record db indication.		VHF DET AF		AC VM	Ballantine 310A	Recorded	
	Observe indicator and adjust 211-A MOD LEVEL control counterclockwise until result is obtained.				VL POWER FLAG light		Light just goes off	
	Observe meter.		VHF DET AF		AC VM	Ballantine 310A	4 ±1.0 db less than db indication recorded in test 3.10.0.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.0	951A-1 Glideslope Receiver Tests										Position 977A-1 MODE switch to ILS							
4.1.0	Glideslope Sensitivity	Adjust OUTPUT LEVEL control per procedure	XTAL switch to 110.1. Adjust FREQUENCY control around 110.10 for red-line indication on RF MONITOR meter	FUNCTION SELECTOR to TONE LOC	110.10 MHz	Observe meter and adjust 232-A OUTPUT LEVEL control counter-clockwise until result is obtained.	Test jig J5	HP-425A	47 ua	110.10 MHz	Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	GS DEV PRI			DC VM	HP-425A	47 ua	
						Observe dial indication.	OUTPUT LEVEL dial	232-A	Less than 10 uv		Observe dial indication.				OUTPUT LEVEL dial	232-A	Less than 10 uv	
4.1.1		Adjust OUTPUT LEVEL control to 10 uv. In turn, adjust FREQUENCY switch to: 334.70 MHz 334.10 MHz 330.50 MHz 335.00 MHz 330.80 MHz 331.10 MHz (corresponds to 313N-( ) or 977A-1 frequencies in the order shown)			108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Observe meter for each pair of listed frequencies. Readjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter for each frequency change.	Test jig J5	HP-425A	Not less than 47 ua	108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Observe meter for each pair of listed frequencies. Readjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter for each frequency change.	GS DEV PRI			DC VM	HP-425A	Not less than 47 ua	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position 977A-1 MODE switch to ILS							
110.10 MHz	Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	GS DEV PRI			DC VM	HP-425A	47 ua	
	Observe dial indication.				OUTPUT LEVEL dial	232-A	Less than 10 uv	
108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Observe meter for each pair of listed frequencies. Readjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter for each frequency change.	GS DEV PRI			DC VM	HP-425A	Not less than 47 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.2.0	Glideslope quieting and receiver gain	FREQUENCY switch to 332.00 MHz. OUTPUT LEVEL to 100 uv. MOD switch to 1000 ~ . Adjust MOD LEVEL control for 30-percent modulation.	OSC SEL switch to MO. Adjust FREQUENCY control around 109.30 MHz for maximum indication on RF MONITOR meter. Adjust RF LEVEL control for red-line indication on RF MONITOR meter.		109.30 MHz	Adjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter. Observe meter and record db indication.	Test connector adapter unit J25 and grd	Ballantine 310A	Recorded
4.2.1		MOD switch to OFF				Observe meter.	Test connector adapter unit J25 and grd	Ballantine 310A	Not less than db below db indication recorded in test 4.2.0
4.2.2		OUTPUT LEVEL to 0 uv (full counterclockwise)				Observe meter.	Test connector unit J11 and grd	HP-400D	Not less than +6.5 vdc

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position 977A-1 MODE switch to ILS							
110.10 MHz	Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	GS DEV PRI			DC VM	HP-425A	47 ua	
	Observe dial indication.				OUTPUT LEVEL dial	232-A	Less than 10 uv	
108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Observe meter for each pair of listed frequencies. Readjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter for each frequency change.	GS DEV PRI			DC VM	HP-425A	Not less than 47 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.2.0	Glideslope quieting and receiver gain	FREQUENCY switch to 332.00 MHz. OUTPUT LEVEL to 100 uv. MOD switch to 1000 ~ . Adjust MOD LEVEL control for 30-percent modulation.	OSC SEL switch to MO. Adjust FREQUENCY control around 109.30 MHz for maximum indication on RF MONITOR meter. Adjust RF LEVEL control for red-line indication on RF MONITOR meter.		109.30 MHz	Adjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter. Observe meter and record db indication.	Test connector adapter unit J25 and grd	Ballantine 310A	Recorded	109.30 MHz	Adjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter. Observe meter and record db indication.		UHF DET AF		AC VM	Ballantine 310A	Recorded	
4.2.1		MOD switch to OFF				Observe meter.	Test connector adapter unit J25 and grd	Ballantine 310A	Not less than 30 db below db indication recorded in test 4.2.0		Observe meter.		UHF DET AF		AC VM	Ballantine 310A	Not less than 30 db below db indication recorded in test 4.2.0.	
4.2.2		OUTPUT LEVEL to 0 uv (full counterclockwise)				Observe meter.	Test connector unit J11 and grd	HP-400D	Not less than +6.5 vdc		Observe meter.	UHF AGC			DC VM	HP-400D	Not less than +6.5 vdc	

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	PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
	FREQUENCY	PROCEDURE	OUTPUT						
			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	109.30 MHz	Adjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter. Observe meter and record db indication.		UHF DET AF		AC VM	Ballantine 310A	Recorded	
30 ndi- ed		Observe meter.		UHF DET AF		AC VM	Ballantine 310A	Not less than 30 db below db indication recorded in test 4.2.0.	
		Observe meter.	UHF AGC			DC VM	HP-400D	Not less than +6.5 vdc	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.3.0	Glideslope centering and deviation	OUTPUT LEVEL control to 700 uv. MOD switch to 90-150~ . DB TONE RATIO switch to CAL 90~ . Adjust MOD LEVEL control for 40-percent modulation. Recheck with DB TONE RATIO switch at CAL 150~ . After modulation check is complete, position DB TONE RATIO switch to 0.				Observe meter.	Test jig J5	HP-425A	0 ua (centered)
4.3.1		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				Observe meter.	Test jig J5	HP-425A	78 ua
4.3.2		DB TONE RATIO switch to 0				Insert a phone plug into test jig J5. NOTE: HP-425A should be floating for this test. Observe meter.	Sleeve of phone plug (+DN) and test connector adapter unit J24	HP-425A	0 ua (centered)
4.3.3		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				NOTE: HP-425A should be floating for this test. Observe meter. Remove phone plug from test jig J5.	Sleeve of phone plug (+DN) and test connector adapter unit J24	HP-425A	0 ua (centered)
		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)	OSC SEL switch to MO. FREQUENCY to 109.30 MHz.	FUNCTION SELECTOR to TONE LOC	109.30 MHz				

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
109.30 MHz	Adjust 232-A CARRIER ADJUST control for red-line indication on CARRIER MONITOR meter. Observe meter and record db indication.		UHF DET AF		AC VM	Ballantine 310A	Recorded	
	Observe meter.		UHF DET AF		AC VM	Ballantine 310A	Not less than 30 db below db indication recorded in test 4.2.0.	
	Observe meter.	UHF AGC			DC VM	HP-400D	Not less than +6.5 vdc	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.3.0	Glideslope centering and deviation	OUTPUT LEVEL control to 700 uv. MOD switch to 90-150~ . DB TONE RATIO switch to CAL 90~ . Adjust MOD LEVEL control for 40-percent modulation. Recheck with DB TONE RATIO switch at CAL 150~ . After modulation check is complete, position DB TONE RATIO switch to 0.				Observe meter.	Test jig J5	HP-425A	0 ua (centered)		Observe meter.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (glideslope receiver Z5R41) until result is obtained.
4.3.1		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				Observe meter.	Test jig J5	HP-425A	78 ua		Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ua	If necessary, adjust PRI SENS control (glideslope receiver Z5R11) until result is obtained.
4.3.2		DB TONE RATIO switch to 0				Insert a phone plug into test jig J5. NOTE: HP-425A should be floating for this test. Observe meter.	 Sleeve of phone plug (+DN) and test connector adapter unit J24	 HP-425A	 0 ua (centered)		NOTE: HP-425A should be floating for this test. Observe meter.	 GS DEV DIF			 DC VM	 HP-425A	 0 ua (centered)	If necessary, adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
4.3.3		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				NOTE: HP-425A should be floating for this test. Observe meter. Remove phone plug from test jig J5.	 Sleeve of phone plug (+DN) and test connector adapter unit J24	 HP-425A	 0 ua (centered)		NOTE: HP-425A should be floating for this test. Qbserve meter.	 GS DEV DIF			 DC VM	 HP-425A	 0 ua (centered)	If necessary, adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.
		DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)	OSC SEL switch to MO. FREQUENCY to 109.30 MHz.	FUNCTION SELECTOR to TONE LOC	109.30 MHz					109.30 MHz		GS DEV DIF	UHF DET AF	MON LOGIC				

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (glideslope receiver Z5R41) until result is obtained.
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ua	If necessary, adjust PRI SENS control (glideslope receiver Z5R11) until result is obtained.
	NOTE: HP-425A should be floating for this test. Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	NOTE: HP-425A should be floating for this test. Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.
109.30 MHz		GS DEV DIF	UHF DET AF	MON LOGIC				

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.4.0	Glideslope sensor					Adjust LOGIC DET control (glideslope receiver Z13R40) clockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just go off
						Observe meter and record indication.	Test connector adapter unit J9 and grd	HP-410B	Recorded
4.4.1						Adjust LOGIC DET control (glideslope receiver Z13R40) counterclockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just go off
						Observe meter and record indication.	Test connector adapter unit J9 and grd	HP-410B	Recorded
4.4.2						Observe meter and adjust LOGIC DET control (glideslope receiver Z13R40) to center of voltage range obtained in tests 4.4.0 and 4.4.1 (use voltages of tests 4.4.0 and 4.4.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 4.4.0 or 4.4.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the ranges, or in this example, 9 volts.	Test connector adapter unit J9 and grd	HP-410B	Adjusted to center of voltage rang
4.4.3		DB TONE RATIO switch to 0				Adjust SEC CTR control (glideslope receiver Z5R45 until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just go off
						NOTE: HP-425A should be floating for this test.			
						Insert phone plug into test jig J5 and observe meter (connected between test points).	Sleeve of phone plug and test connector adapter unit J24	HP-425A	5 ±0.5 ua
4.4.4						Adjust GATE WID control (glideslope receiver Z13R38) until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just go off
						Remove phone plug installed in test 4.4.3.			
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	0 ua (center
4.4.5						Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel).			
						Observe meter and record db indication and vac indication.	232-A METER CALIB jacks	Ballantine 310A	Recorded
4.4.6		Adjust MOD LEVEL control per procedure				Observe meter and adjust 232-A MOD LEVEL control counterclockwise until result is obtained.	232-A METER CALIB jacks	Ballantine 310A	2 db less tha db indication recorded in test 4.4.5

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust PRI CTR control (glideslope receiver Z5R41) until result is obtained.
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ua	If necessary, adjust PRI SENS control (glideslope receiver Z5R11) until result is obtained.
	NOTE: HP-425A should be floating for this test. Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	NOTE: HP-425A should be floating for this test. Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	If necessary, adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.
109.30 MHz		GS DEV DIF	UHF DET AF	MON LOGIC				

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
4.4.0	Glideslope sensor					Adjust LOGIC DET control (glideslope receiver Z13R40) clockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just goes off		Adjust LOGIC DET control (glideslope receiver Z13R40) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
						Observe meter and record indication.	Test connector adapter unit J9 and grd	HP-410B	Recorded		Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
4.4.1						Adjust LOGIC DET control (glideslope receiver Z13R40) counterclockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just goes off		Adjust LOGIC DET control (glideslope receiver Z13R40) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
						Observe meter and record indication.	Test connector adapter unit J9 and grd	HP-410B	Recorded		Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
4.4.2						Observe meter and adjust LOGIC DET control (glideslope receiver Z13R40) to center of voltage range obtained in tests 4.4.0 and 4.4.1 (use voltages of tests 4.4.0 and 4.4.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 4.4.0 or 4.4.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the ranges, or in this example, 9 volts.	Test connector adapter unit J9 and grd	HP-410B	Adjusted to center of voltage range		Observe meter and adjust LOGIC DET control (glideslope receiver Z13R40) to center of voltage range obtained in tests 4.4.0 and 4.4.1 (use voltages of tests 4.4.0 and 4.4.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 4.4.0 or 4.4.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	GS LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
4.4.3		DB TONE RATIO switch to 0				Adjust SEC CTR control (glideslope receiver Z5R45 until result is obtained. NOTE: HP-425A should be floating for this test.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just goes off		Adjust SEC CTR control (glideslope receiver Z5R40) until result is obtained. NOTE: HP-425A should be floating for this test.				GS POWER FLAG light		Light just goes off	
						Insert phone plug into test jig J5 and observe meter (connected between test points).	Sleeve of phone plug and test connector adapter unit J24	HP-425A	5 ±0.5 ua		Observe meter.	GS DEV DIF			DC VM	HP-425A	5 ±0.5 ua	If necessary, readjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
4.4.4						Adjust GATE WID control (glideslope receiver Z13R38) until result is obtained. Remove phone plug installed in test 4.4.3.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light just goes off		Adjust GATE WID control (glideslope receiver Z13R38) until result is obtained.				GS POWER FLAG light		Light just goes off	
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	0 ua (centered)		Observe meter.	GS DEV SEC			DC VM	HP-425A	0 ua (centered)	Adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
4.4.5						Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel).					Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel).							
						Observe meter and record db indication and vac indication.	232-A METER CALIB jacks	Ballantine 310A	Recorded		Observe meter and record db indication and vac indication.				232-A METER CALIB jacks	Ballantine 310A	Recorded	
4.4.6		Adjust MOD LEVEL control per procedure				Observe meter and adjust 232-A MOD LEVEL control counterclockwise until result is obtained.	232-A METER CALIB jacks	Ballantine 310A	2 db less than db indication recorded in test 4.4.5		Observe meter and adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A METER CALIB jacks	Ballantine 310A	2 db less than db indication recorded in test 4.4.5	

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust LOGIC DET control (glideslope receiver Z13R40) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
	Adjust LOGIC DET control (glideslope receiver Z13R40) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
	Observe meter and adjust LOGIC DET control (glideslope receiver Z13R40) to center of voltage range obtained in tests 4.4.0 and 4.4.1 (use voltages of tests 4.4.0 and 4.4.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 4.4.0 or 4.4.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	GS LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
	Adjust SEC CTR control (glideslope receiver Z5R40) until result is obtained.				GS POWER FLAG light		Light just goes off	
	NOTE: HP-425A should be floating for this test.							
	Observe meter.	GS DEV DIF			DC VM	HP-425A	5 ±0.5 ua	If necessary, readjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	Adjust GATE WID control (glideslope receiver Z13R38) until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	0 ua (centered)	Adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel).							
	Observe meter and record db indication and vac indication.				232-A METER CALIB jacks	Ballantine 310A	Recorded	
	Observe meter and adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A METER CALIB jacks	Ballantine 310A	2 db less than db indication recorded in test 4.4.5	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.4.7						CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe HI POWER GLIDESLOPE FLAG light on test jig. If light is off, adjust FLAG THRESHOLD control (glideslope receiver Z13R70) clockwise approximately 8 turns. HI POWER GLIDESLOPE FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (glideslope receiver Z13R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.			
4.4.8		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.5. Observe indicator.	Test jig HI POWER GLIDE-SLOPE FLAG light		Light is on
4.4.9						Observe meter and record db indication and vac indication.	232-A modulation jacks	Ballantine 310A	Recorded
4.4.10		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control counterclockwise until result is obtained.	232-A modulation jacks	Ballantine 310A	2 db less tha db indication recorded in test 4.4.9
4.4.11						Observe indicator. If necessary, repeat tests 4.4.7 through 4.4.11 until result is obtained (see note in COMMENTS column).	Test jig HI POWER GLIDE-SLOPE FLAG light		Light is off
4.4.12		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.9.			

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust LOGIC DET control (glideslope receiver Z13R40) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
	Adjust LOGIC DET control (glideslope receiver Z13R40) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter and record indication.	GS LOGIC DET			DC VM	HP-410B	Recorded	
	Observe meter and adjust LOGIC DET control (glideslope receiver Z13R40) to center of voltage range obtained in tests 4.4.0 and 4.4.1 (use voltages of tests 4.4.0 and 4.4.1 as end limit voltage range). EXAMPLE: If one voltage indication in test 4.4.0 or 4.4.1 were 13 volts, and the other voltage indication were 5 volts, the LOGIC DET control would be adjusted for the center of the range, or in this example, 9 volts.	GS LOGIC DET			DC VM	HP-410B	Adjusted to center of voltage range	
	Adjust SEC CTR control (glideslope receiver Z5R40) until result is obtained.				GS POWER FLAG light		Light just goes off	
	NOTE: HP-425A should be floating for this test.							
	Observe meter.	GS DEV DIF			DC VM	HP-425A	5 ±0.5 ua	If necessary, readjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	Adjust GATE WID control (glideslope receiver Z13R38) until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	0 ua (centered)	Adjust SEC CTR control (glideslope receiver Z5R45) until result is obtained.
	Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel).							
	Observe meter and record db indication and vac indication.				232-A METER CALIB jacks	Ballantine 310A	Recorded	
	Observe meter and adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A METER CALIB jacks	Ballantine 310A	2 db less than db indication recorded in test 4.4.5	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
4.4.7						CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe HI POWER GLIDESLOPE FLAG light on test jig. If light is off, adjust FLAG THRESHOLD control (glideslope receiver Z13R70) clockwise approximately 8 turns. HI POWER GLIDESLOPE FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (glideslope receiver Z13R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.					CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe GS POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (glideslope receiver Z13R70) clockwise approximately 8 turns. GS POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (glideslope receiver Z13R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.						
4.4.8		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.5. Observe indicator.	 Test jig HI POWER GLIDE-SLOPE FLAG light	 	 Light is on		Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.5. Observe indicator.				 GS POWER FLAG light	 	 Light is on	
4.4.9						Observe meter and record db indication and vac indication.	232-A modulation jacks	Ballantine 310A	Recorded		Observe meter and record db indication and vac indication.				232-A modulation jacks	Ballantine 310A	Recorded	
4.4.10		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control counterclockwise until result is obtained.	232-A modulation jacks	Ballantine 310A	2 db less tha db indication recorded in test 4.4.9		Adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A modulation jacks	Ballantine 310A	Recorded	
4.4.11						Observe indicator. If necessary, repeat tests 4.4.7 through 4.4.11 until result is obtained (see note in COMMENTS column).	Test jig HI POWER GLIDE-SLOPE FLAG light		Light is off		Observe indicator. If necessary, repeat tests 4.4.7 through 4.4.11 until result is obtained (see note in COMMENTS column).				GS POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 4.4.9).
4.4.12		Adjust MOD LEVEL control per procedure				Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.9.					Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.9.							

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe GS POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (glideslope receiver Z13R70) clockwise approximately 8 turns. GS POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (glideslope receiver Z13R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.							
	Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.5. Observe indicator.				GS POWER FLAG light		Light is on	
	Observe meter and record db indication and vac indication.				232-A modulation jacks	Ballantine 310A	Recorded	
	Adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A modulation jacks	Ballantine 310A	Recorded	
	Observe indicator. If necessary, repeat tests 4.4.7 through 4.4.11 until result is obtained (see note in COMMENTS column).				GS POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 4.4.9).
	Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.9.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.5.0	Glideslope deviation monitor	DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				Adjust SEC SENS control (glideslope receiver Z5R21) clockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light.		Light just goe off.
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	Not less than 90 ua, and no more than 10 ua
4.5.1						Adjust SEC SENS control (glideslope receiver Z5R21) counterclockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light.		Light just goe off
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	Not less than 59 ua, and no more than 69
4.5.2						Insert a phone plug into test jig J5			
						NOTE: HP-425A should be floating for this test.			
						Observe meter connected between test points.	Sleeve of phone plug (+DN) and test connector adapter unit J24	HP-425A	0 ua (centered
						Remove phone plug from test jig J5			

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Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	CAUTION: THE FOLLOWING ADJUSTMENT MUST BE DONE SLOWLY DUE TO INTENTIONAL TIME DELAYS BUILT INTO THE CIRCUIT. THE RECOMMENDED METHOD OF ADJUSTING THE FLAG THRESHOLD CONTROL IS TO ROTATE THE CONTROL APPROXIMATELY 3/4 TURN COUNTERCLOCKWISE, WAIT ABOUT 5 TO 10 SECONDS, AND ROTATE ANOTHER 3/4 TURN UNTIL THE RESULT IS OBTAINED. Observe GS POWER FLAG light. If light is off, adjust FLAG THRESHOLD control (glideslope receiver Z13R70) clockwise approximately 8 turns. GS POWER FLAG light should now be on. Slowly adjust FLAG THRESHOLD control (glideslope receiver Z13R70) counterclockwise per the above CAUTION until result is obtained. Once result is obtained, do not rotate control any further in either direction.							
	Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.5. Observe indicator.				GS POWER FLAG light		Light is on	
	Observe meter and record db indication and vac indication.				232-A modulation jacks	Ballantine 310A	Recorded	
	Adjust 232-A MOD LEVEL control counterclockwise until result is obtained.				232-A modulation jacks	Ballantine 310A	Recorded	
	Observe indicator. If necessary, repeat tests 4.4.7 through 4.4.11 until result is obtained (see note in COMMENTS column).				GS POWER FLAG light		Light is off	NOTE: This test checks the flag operation at a reduced modulation level of 2 db. A flag warning (light is off) must occur when the modulation level is reduced 2 db from normal (the level at the beginning of test 4.4.9).
	Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 4.4.9.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.5.0	Glideslope deviation monitor	DB TONE RATIO switch to 2.0 (90 Hz > 150 Hz)				Adjust SEC SENS control (glideslope receiver Z5R21) clockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light.		Light just goes off.		Adjust SEC SENS control (glideslope receiver Z5R21) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	Not less than 90 ua, and not more than 100 ua		Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 90 ua, and not more than 100 ua	
4.5.1						Adjust SEC SENS control (glideslope receiver Z5R21) counterclockwise until result is obtained.	Test jig HI POWER GLIDE-SLOPE FLAG light.		Light just goes off		Adjust SEC SENS control (glideslope receiver Z5R21) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
						Observe meter.	Test connector adapter unit J8 and J24	HP-425A	Not less than 59 ua, and not more than 69 ua		Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 59 ua, and not more than 69 ua	
4.5.2						Insert a phone plug into test jig J5 NOTE: HP-425A should be floating for this test.					NOTE: HP-425A should be floating for this test.							
						Observe meter connected between test points. Remove phone plug from test jig J5	Sleeve of phone plug (+DN) and test connector adapter unit J24	HP-425A	0 ua (centered)		Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	Adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust SEC SENS control (glideslope receiver Z5R21) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 90 ua, and not more than 100 ua	
	Adjust SEC SENS control (glideslope receiver Z5R21) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 59 ua, and not more than 69 ua	
	NOTE: HP-425A should be floating for this test.							
	Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	Adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
4.6.0	Glideslope deviation check					Observe meter.	Test jig J5	HP-425A	78 ±3 ua
4.6.1		DB TONE RATIO switch to 2.0 (150 Hz > 90 Hz)				Observe meter.	Test jig J5	HP-425A	78 ±3 ua

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust SEC SENS control (glideslope receiver Z5R21) clockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 90 ua, and not more than 100 ua	
	Adjust SEC SENS control (glideslope receiver Z5R21) counterclockwise until result is obtained.				GS POWER FLAG light		Light just goes off	
	Observe meter.	GS DEV SEC			DC VM	HP-425A	Not less than 59 ua, and not more than 69 ua	
	NOTE: HP-425A should be floating for this test.							
	Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ua (centered)	Adjust SEC SENS control (glideslope receiver Z5R21) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.6.0	Glideslope deviation check					Observe meter.	Test jig J5	HP-425A	78 ±3 ua		Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	
4.6.1		DB TONE RATIO switch to 2.0 (150 Hz > 90 Hz)				Observe meter.	Test jig J5	HP-425A	78 ±3 ua		Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
		DB TONE RATIO switch to 2.0 (150 Hz > 90 Hz)	OSC SEL switch to MO. FREQUENCY to 109.30 MHz	FUNCTION SELECTOR to TONE LOC	109.30 MHz				
5.0	Test generator and timer tests	Position POWER switch to OFF	OSC SEL switch to XTAL. XTAL switch to 114.9. Adjust FREQUENCY control around 114.90 MHz for maximum indication on RF MONITOR meter. Adjust RF LEVEL control for red-line indication on RF MONITOR meter	FUNCTION SELECTOR to SPECIFIC SIGNAL SPECIFIC SIGNAL SELECTOR to 30~ VAR ϕ		Disconnect 232-A from test jig J3.			
5.0.1			Adjust MOD LEVEL control per procedure			Observe meter and adjust 211-A MOD LEVEL control until result is obtained. If necessary, readjust RF LEVEL control for red-line indication on RF MONITOR meter.	211-A	PERCENT MODULATION meter.	Meter indicates 30 percent

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	
	Observe meter.	GS DEV PRI			DC VM	HP-425A	78 ±3 ua	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
		DB TONE RATIO switch to 2.0 (150 Hz > 90 Hz)	OSC SEL switch to MO. FREQUENCY to 109.30 MHz	FUNCTION SELECTOR to TONE LOC	109.30 MHz					109.30 MHz		GS DEV PRI	UHF DET AF	MON LOGIC				
5.0	Test generator and timer tests	Position POWER switch to OFF	OSC SEL switch to XTAL. XTAL switch to 114.9. Adjust FREQUENCY control around 114.90 MHz for maximum indication on RF MONITOR meter. Adjust RF LEVEL control for red-line indication on RF MONITOR meter	FUNCTION SELECTOR to SPECIFIC SIGNAL SPECIFIC SIGNAL SELECTOR to 30~ VAR ϕ		Disconnect 232-A from test jig J3.					Disconnect 232-A from 977A-1 UHF IN jack.							
5.0.1			Adjust MOD LEVEL control per procedure			Observe meter and adjust 211-A MOD LEVEL control until result is obtained. If necessary, readjust RF LEVEL control for red-line indication on RF MONITOR meter.	211-A	PERCENT MODULATION meter.	Meter indicates 30 percent		Observe meter and adjust 211-A MOD LEVEL control until result is obtained. If necessary, readjust RF LEVEL control for red-line indication on RF MONITOR meter.				211-A	PERCENT MODULATION meter.	Meter indicates 30 percent	

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
109.30 MHz		GS DEV PRI	UHF DET AF	MON LOGIC				
	Disconnect 232-A from 977A-1 UHF IN jack.							
	Observe meter and adjust 211-A MOD LEVEL control until result is obtained. If necessary, readjust RF LEVEL control for red-line indication on RF MONITOR meter.				211-A	PERCENT MODULATION meter.	Meter indicates 30 percent	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
5.1.0	Test generator, VOR section					Temporarily disconnect 211-A fron test jig J4.			
5.1.1						Actuate VOR TEST switch (at front of 51RV-2B) and observe counter. Release VOR TEST switch and remove HP-5245L from test jig. NOTE: Disregard the note in the COMMENTS column if the test generator and timer has been modified by performing the wiring options in the testing section of the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual. These wiring options change the timing sequences.	Test jig J9 and J10 (AUDIO LOAD)	HP-5245L	900 ± 10 Hz (See note in COMMENTS column)
5.1.2				FUNCTION SELECTOR to ODR		Reconnect 211-A RF OUTPUT to test jig J4. Observe meter and record indication	Test connector adapter unit J31 and grd	HP-410B	Recorded
5.1.3						Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	Test connector adapter unit J31 and grd	HP-410B	Same as recorded in test 5.1.2
5.1.4						Observe meter, and record indication.	Test connector adapter unit J20 and grd	Ballantine 310A	Recorded
5.1.5						Actuate VOR TEST switch (at front of 51RV-2B) and observe indicators. Release VOR TEST switch.	Test connector adapter unit J20 and grd	Ballantine 310A	Same as recorded in test 5.1.4
5.1.6				PHASE ANGLE SELECTOR to 90 degrees		Adjust 479V-3 BEARING DEGREES switch to 0 degree Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	Test jig J7 and RMI pointer	HP-425A	0 ua on HP-425A, and 180 ±1 degrees on RMI

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PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
109.30 MHz		GS DEV PRI	UHF DET AF	MON LOGIC				
	Disconnect 232-A from 977A-1 UHF IN jack.							
	Observe meter and adjust 211-A MOD LEVEL control until result is obtained. If necessary, readjust RF LEVEL control for red-line indication on RF MONITOR meter.				211-A	PERCENT MODULATION meter.	Meter indicates 30 percent	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
5.1.0	Test generator, VOR section					Temporarily disconnect 211-A fron test jig J4.					Temporarily disconnect 211-A from 977A-1 VHF IN jack. Position 977A-1 MODE switch to VOR.							
5.1.1						Actuate VOR TEST switch (at front of 51RV-2B) and observe counter. Release VOR TEST switch and remove HP-5245L from test jig. NOTE: Disregard the note in the COMMENTS column if the test generator and timer has been modified by performing the wiring options in the testing section of the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual. These wiring options change the timing sequences.	Test jig J9 and J10 (AUDIO LOAD)	HP-5245L	900 ± 10 Hz (See note in COMMENTS column)		Actuate VOR TEST switch (at front of 51RV-2B) and observe counter. Release VOR TEST switch and remove HP-5245L from 977A-1. NOTE: The SELF-TEST switches on the 977A-1 should not be used for this test, or any of the following tests. NOTE: Disregard the note in the COMMENTS column.			VL AF	CRO	HP-5245L	900 ±10 Hz (See note in COMMENTS column)	If necessary, adjust 900 FREQ control (vhf receiver Z2R5) until result is obtained. NOTE: A delay of approximately 3 seconds occurs between the time any of the test generator switches are actuated and an output indication is provided. This delay is normal, and is a function of the timer circuit in the test generator and timer. Also, if any of the test generator switches remain actuated for approximately 23 seconds, the output indication will be removed. This is normal, and is due to the timer circuit in the test generator and timer. It will be necessary to release the test switch momentarily, and actuate the switch again. After approximately 3 seconds have elapsed, the output indication will return.
5.1.2				FUNCTION SELECTOR to ODR		Reconnect 211-A RF OUTPUT to test jig J4. Observe meter and record indication.	Test connector adapter unit J31 and grd	HP-410B	Recorded		Reconnect 211-A RF OUTPUT to 977A-1 VHF IN jack. Observe meter and record indication.	9960 FM DET			DC VM	HP-410B	Recorded	
5.1.3						Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	Test connector adapter unit J31 and grd	HP-410B	Same as recorded in test 5.1.2		Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	9960 FM DET			DC VM	HP-410B	Same as recorded in test 5.1.2	If necessary, adjust 9960 FREQ control (vhf receiver Z2R27) until result is obtained.
5.1.4						Observe meter, and record indication.	Test connector adapter unit J20 and grd	Ballantine 310A	Recorded		Observe meter and record indication.		30 Hz VAR		AC VM	Ballantine 310A	Recorded	
5.1.5						Actuate VOR TEST switch (at front of 51RV-2B) and observe indicators. Release VOR TEST switch.	Test connector adapter unit J20 and grd	Ballantine 310A	Same as recorded in test 5.1.4		Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.		30 Hz VAR		AC VM	Ballantine 310A	Same as recorded in test 5.1.4	If necessary, adjust 30 Hz LVL control (vhf receiver Z2R86) until result is obtained.
5.1.6				PHASE ANGLE SELECTOR to 90 degrees		Adjust 479V-3 BEARING DEGREES switch to 0 degree Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	Test jig J7 and RMI pointer	HP-425A	0 ua on HP-425A, and 180 ±1 degrees on RMI		Adjust 479V-3 BEARING DEGREES switch to 0 degree. Actuate VOR TEST switch (at front of 51RV-2B) and observe indicators. Release VOR TEST switch.	VL DEV PRI			DC VM and RMI pointer	HP-425A	0 ua on HP-425A, and 180 ±1 degrees on RMI	If necessary, adjust VOR ZERO control (vhf receiver Z2R33) until result is obtained.

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Figure 704

FREQUENCY	PROCEDURE 2 USING 977A-1 TEST PANEL PROCEDURE	OUTPUT DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
	Temporarily disconnect 211-A from 977A-1 VHF IN jack. Position 977A-1 MODE switch to VOR.							
	Actuate VOR TEST switch (at front of 51RV-2B) and observe counter. Release VOR TEST switch and remove HP-5245L from 977A-1. NOTE: The SELF-TEST switches on the 977A-1 should not be used for this test, or any of the following tests. NOTE: Disregard the note in the COMMENTS column.			VL AF	CRO	HP-5245L	900 ±10 Hz (See note in COMMENTS column)	If necessary, adjust 900 FREQ control (vhf receiver Z2R5) until result is obtained. NOTE: A delay of approximately 3 seconds occurs between the time any of the test generator switches are actuated and an output indication is provided. This delay is normal, and is a function of the timer circuit in the test generator and timer. Also, if any of the test generator switches remain actuated for approximately 23 seconds, the output indication will be removed. This is normal, and is due to the timer circuit in the test generator and timer. It will be necessary to release the test switch momentarily, and actuate the switch again. After approximately 3 seconds have elapsed, the output indication will return.
	Reconnect 211-A RF OUTPUT to 977A-1 VHF IN jack. Observe meter and record indication.	9960 FM DET			DC VM	HP-410B	Recorded	
	Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	9960 FM DET			DC VM	HP-410B	Same as recorded in test 5.1.2	If necessary, adjust 9960 FREQ control (vhf receiver Z2R27) until result is obtained.
	Observe meter and record indication.		30 Hz VAR		AC VM	Ballantine 310A	Recorded	
	Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.		30 Hz VAR		AC VM	Ballantine 310A	Same as recorded in test 5.1.4	If necessary, adjust 30 Hz LVL control (vhf receiver Z2R86) until result is obtained.
	Adjust 479V-3 BEARING DEGREES switch to 0 degree. Actuate VOR TEST switch (at front of 51RV-2B) and observe indicators. Release VOR TEST switch.	VL DEV PRI			DC VM and RMI pointer	HP-425A	0 ua on HP-425A, and 180 ±1 degrees on RMI	If necessary, adjust VOR ZERO control (vhf receiver Z2R33) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
5.2.0	Test generator, ILS section		No changes required	No changes required	110.10 MHz	Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	Test jig J7	HP-425A	0 ua (centered)
5.2.1						Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	Test jig J5	HP-425A	0 ua (centered)
5.2.2						Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	Test jig J7	HP-425A	75 ±2 ua
5.2.3						Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	Test jig J5	HP-425A	75 ±2 ua
						Actuate DN/R test switch (at front of 51RV-2B) and observe both meters.	Test jig J5 and J7	HP-425A (2 reqd)	75 ±2 ua

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FREQUENCY	PROCEDURE 2 USING 977A-1 TEST PANEL							COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Temporarily disconnect 211-A from 977A-1 VHF IN jack. Position 977A-1 MODE switch to VOR.							
	Actuate VOR TEST switch (at front of 51RV-2B) and observe counter. Release VOR TEST switch and remove HP-5245L from 977A-1. NOTE: The SELF-TEST switches on the 977A-1 should not be used for this test, or any of the following tests. NOTE: Disregard the note in the COMMENTS column.			VL AF	CRO	HP-5245L	900 ±10 Hz (See note in COMMENTS column)	If necessary, adjust 900 FREQ control (vhf receiver Z2R5) until result is obtained. NOTE: A delay of approximately 3 seconds occurs between the time any of the test generator switches are actuated and an output indication is provided. This delay is normal, and is a function of the timer circuit in the test generator and timer. Also, if any of the test generator switches remain actuated for approximately 23 seconds, the output indication will be removed. This is normal, and is due to the timer circuit in the test generator and timer. It will be necessary to release the test switch momentarily, and actuate the switch again. After approximately 3 seconds have elapsed, the output indication will return.
	Reconnect 211-A RF OUTPUT to 977A-1 VHF IN jack. Observe meter and record indication.	9960 FM DET			DC VM	HP-410B	Recorded	
	Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.	9960 FM DET			DC VM	HP-410B	Same as recorded in test 5.1.2	If necessary, adjust 9960 FREQ control (vhf receiver Z2R27) until result is obtained.
	Observe meter and record indication.		30 Hz VAR		AC VM	Ballantine 310A	Recorded	
	Actuate VOR TEST switch (at front of 51RV-2B) and observe meter. Release VOR TEST switch.		30 Hz VAR		AC VM	Ballantine 310A	Same as recorded in test 5.1.4	If necessary, adjust 30 Hz LVL control (vhf receiver Z2R86) until result is obtained.
	Adjust 479V-3 BEARING DEGREES switch to 0 degree. Actuate VOR TEST switch (at front of 51RV-2B) and observe indicators. Release VOR TEST switch.	VL DEV PRI			DC VM and RMI pointer	HP-425A	0 ua on HP-425A, and 180 ±1 degrees on RMI	If necessary, adjust VOR ZERO control (vhf receiver Z2R33) until result is obtained.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
5.2.0	Test generator, ILS section		No changes required	No changes required	110.10 MHz	Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	Test jig J7	HP-425A	0 ua (centered)	110.10 MHz	Position 977A-1 MODE switch to ILS. Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust LOC BAL control (vhf receiver Z2R70) until result is obtained.
5.2.1						Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	Test jig J5	HP-425A	0 ua (centered)		Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust GS BAL control (vhf receiver Z2R75) until result is obtained.
5.2.2						Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	Test jig J7	HP-425A	75 ±2 ua		Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	VL DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust LOC LVL control (vhf receiver Z2R79) until result is obtained.
5.2.3						Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	Test jig J5	HP-425A	75 ±2 ua		Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	GS DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust GS LVL control (vhf receiver Z2R78) until result is obtained.
						Actuate DN/R test switch (at front of 51RV-2B) and observe both meters.	Test jig J5 and J7	HP-425A (2 reqd)	75 ±2 ua		Actuate DN/R test switch (at front of 51RV-2B) and observe meter.	GS DEV PRI VL DEV PRI			DC VM DC VM	HP-425A HP-425A	75 ±2 ua 75 ±2 ua	Repeat test 5.2.0, 5.2.1, and 5.2.2 if results are not as specified.

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 28 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
110.10 MHz	Position 977A-1 MODE switch to ILS. Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust LOC BAL control (vhf receiver Z2R70) until result is obtained.
	Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust GS BAL control (vhf receiver Z2R75) until result is obtained.
	Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	VL DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust LOC LVL control (vhf receiver Z2R79) until result is obtained.
	Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	GS DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust GS LVL control (vhf receiver Z2R78) until result is obtained.
	Actuate DN/R test switch (at front of 51RV-2B) and observe meter.	GS DEV PRI VL DEV PRI			DC VM DC VM	HP-425A HP-425A	75 ±2 ua 75 ±2 ua	Repeat test 5.2.0, 5.2.1, and 5.2.2 if results are not as specified.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
6.0	End of test					Remove power from all test equipment. Remove test equipment and 51RV-2B from test jig. Replace 51RV-2B front panel and secure with six screws (three on top and three on bottom).			

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 29 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
110.10 MHz	Position 977A-1 MODE switch to ILS. Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	VL DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust LOC BAL control (vhf receiver Z2R70) until result is obtained.
	Simultaneously actuate UP/L test switch and DN/R test switch (at front of 51RV-2B) and observe meter. Release both test switches.	GS DEV PRI			DC VM	HP-425A	0 ua (centered)	If necessary, adjust GS BAL control (vhf receiver Z2R75) until result is obtained.
	Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	VL DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust LOC LVL control (vhf receiver Z2R79) until result is obtained.
	Actuate UP/L test switch (at front of 51RV-2B) and observe meter. Release UP/L test switch.	GS DEV PRI			DC VM	HP-425A	75 ±2 ua	If necessary, adjust GS LVL control (vhf receiver Z2R78) until result is obtained.
	Actuate DN/R test switch (at front of 51RV-2B) and observe meter.	GS DEV PRI VL DEV PRI			DC VM DC VM	HP-425A HP-425A	75 ±2 ua 75 ±2 ua	Repeat test 5.2.0, 5.2.1, and 5.2.2 if results are not as specified.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
6.0	End of test					Remove power from all test equipment. Remove test equipment and 51RV-2B from test jig. Replace 51RV-2B front panel and secure with six screws (three on top and three on bottom).					Remove power from all test equipment. Remove test equipment and 51RV-2B from 977A-1 Test Panel. Replace 51RV-2B front panel and secure with six screws (three on top and three on bottom).							

51RV-2B VOR/ILS Receiver, Test Procedures (Sheet 29 of 29)
Figure 704

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Remove power from all test equipment. Remove test equipment and 51RV-2B from 977A-1 Test Panel. Replace 51RV-2B front panel and secure with six screws (three on top and three on bottom).							

51RV-2B VOR/ILS Receiver - Troubleshooting

1. GENERAL.

This section presents troubleshooting procedures for the 51RV-2B VOR/ILS Receiver. The procedures in this section allow the technician to isolate trouble to a particular planar assembly. The suspect planar assembly should be removed (per the disassembly section) and subjected to the detailed test and troubleshooting procedures provided in the respective individual planar assembly overhaul manual.

The schematic diagram for the 51RV-2B Interconnect Unit is also shown in this section. The schematic diagram for each individual planar assembly is contained in the respective planar assembly overhaul manual.

2. TEST EQUIPMENT AND POWER REQUIREMENTS.

A. Test Equipment.

Refer to the special tools, fixtures, and equipment section of this manual for test equipment required to troubleshoot the 51RV-2B VOR/ILS Receiver.

CAUTION: ENSURE THAT ALL TEST EQUIPMENT IS PROPERLY CALIBRATED BEFORE BEGINNING THE TROUBLESHOOTING PROCEDURES. PARAGRAPH 4 IN THE TESTING SECTION PROVIDES PROCEDURES TO ENSURE THAT THE 211-A, 232-A, AND 479S-3 SIGNAL GENERATORS ARE PROPERLY ADJUSTED.

B. Power Sources.

A +27.5-volt dc ±2 percent power source, a 26-volt ±2 percent 400-Hz ±5 percent, and a 115-volt ±10 percent 60-Hz power source are required to troubleshoot the 51RV-2B.

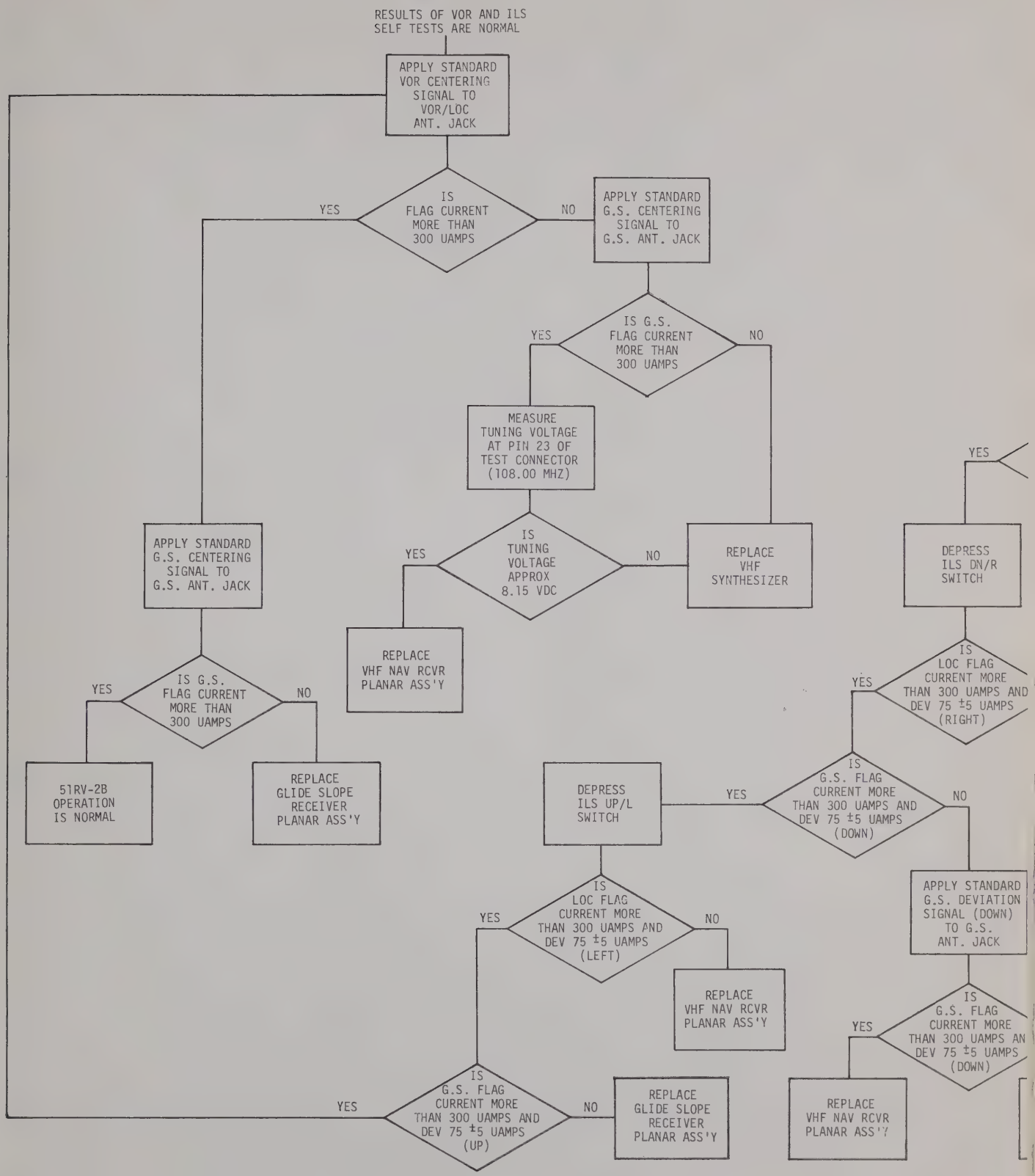
3. PROCEDURE.

A. Troubleshooting Setup.

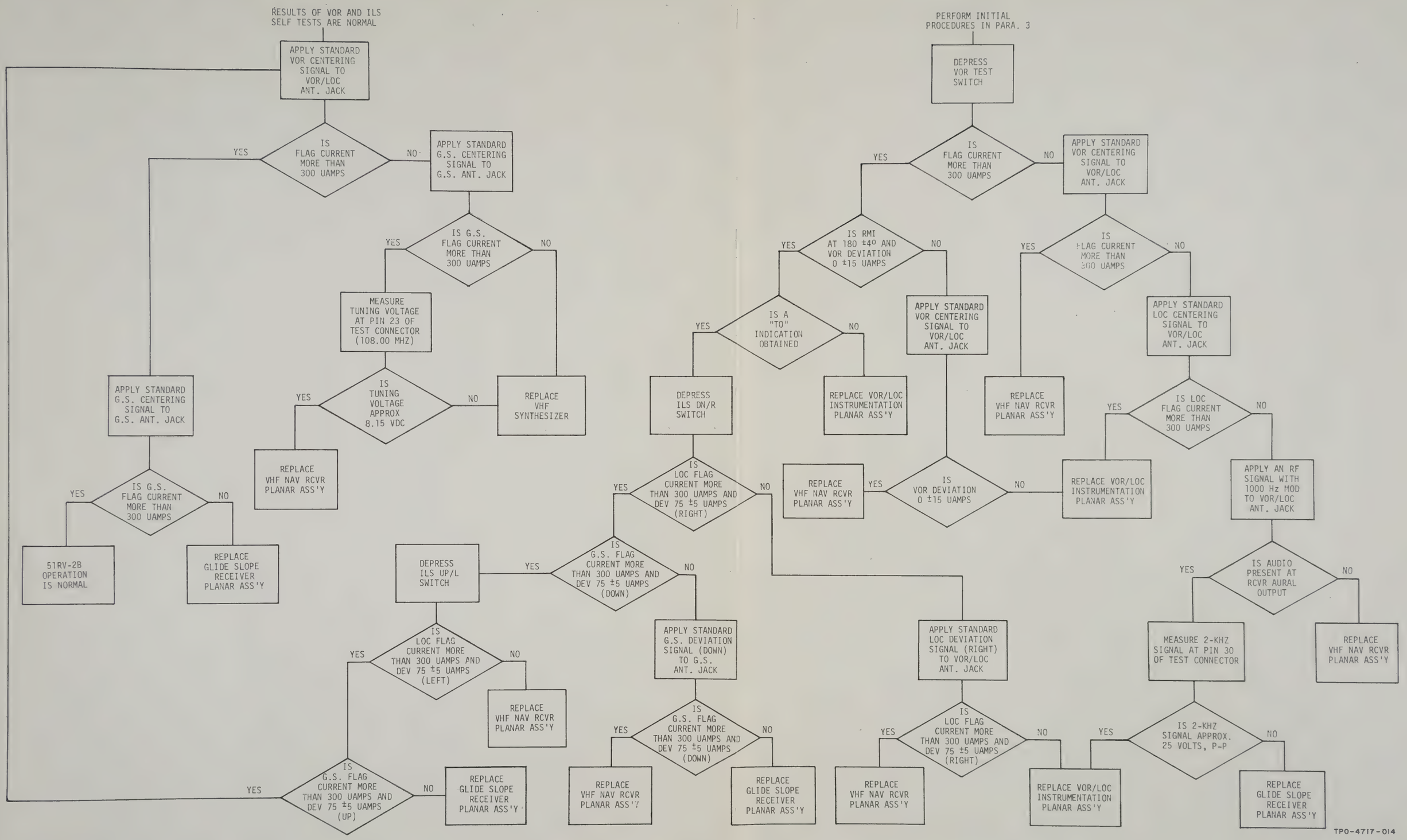
If standard test equipment is being used, connect the 51RV-2B to the test jig and test equipment as shown in figure 701. If the Collins 977A-1 Test Panel is being used, connect the 51RV-2B to the 977A-1 and test equipment as shown in figure 702.

B. Use of Troubleshooting Procedures.

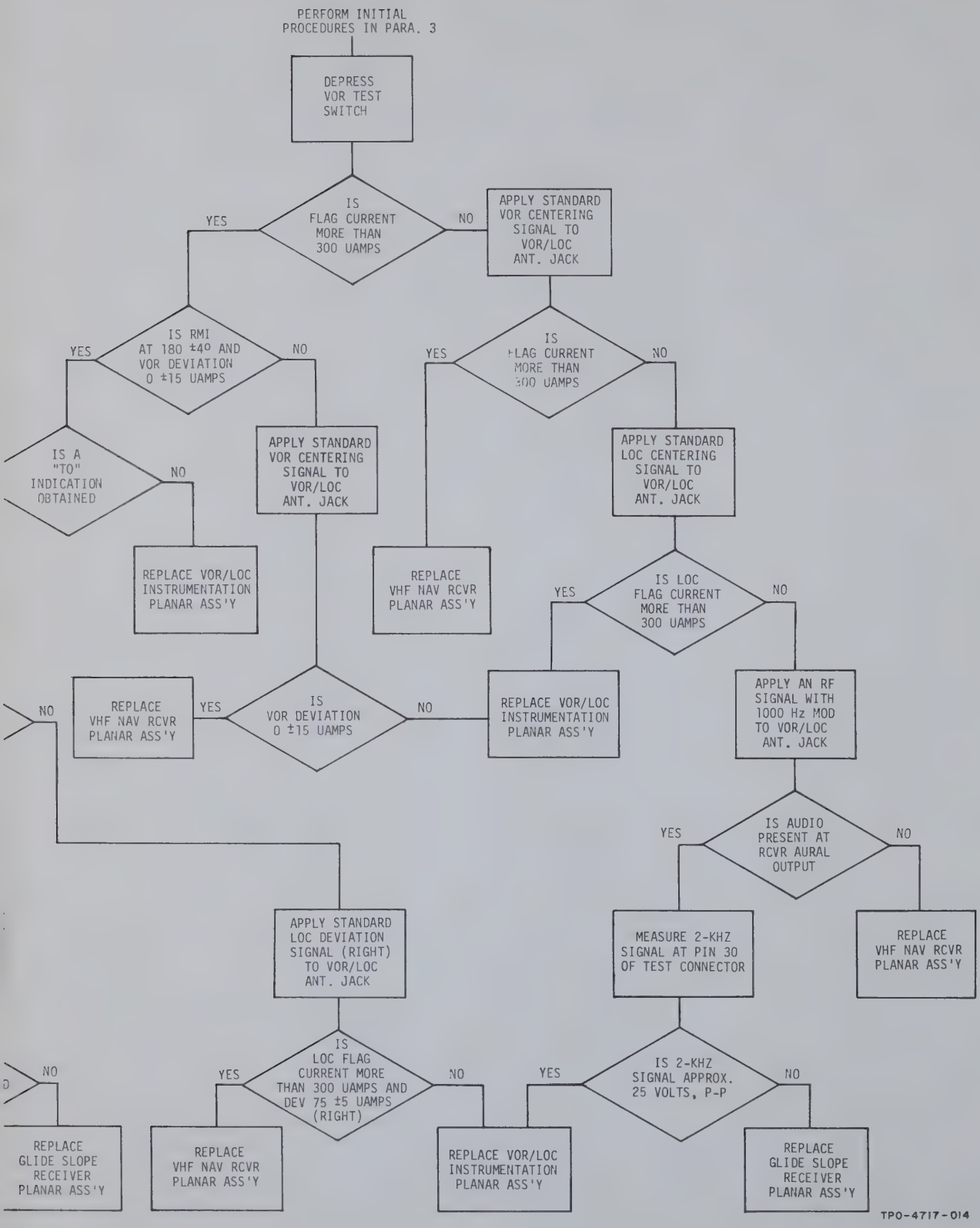
Perform the tests shown in figure 704 before proceeding to the 51RV-2B trouble-shooting chart, figure 801. Results obtained from the tests in figure 704 will indicate the overall performance of the 51RV-2B.


RESULTS OF VOR AND ILS SELF TESTS ARE NORMAL
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
IS FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
APPLY STANDARD G.S. CENTERING SIGNAL TO G.S. ANT. JACK
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
MEASURE TUNING VOLTAGE AT PIN 23 OF TEST CONNECTOR (108.00 MHZ)
IS TUNING VOLTAGE APPROX 8.15 VDC
YES
NO
REPLACE VHF SYNTHESIZER
REPLACE VHF NAV RCVR PLANAR ASS'Y
APPLY STANDARD G.S. CENTERING SIGNAL TO G.S. ANT. JACK
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
51RV-2B OPERATION IS NORMAL
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
YES
DEPRESS ILS DN/R SWITCH
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (RIGHT)
YES
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (DOWN)
YES
NO
DEPRESS ILS UP/L SWITCH
APPLY STANDARD G.S. DEVIATION SIGNAL (DOWN) TO G.S. ANT. JACK
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (LEFT)
YES
NO
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AN DEV 75 ±5 UAMPS (DOWN)
YES
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (UP)
YES
NO
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y

51RV-2B Troubleshooting Chart
Figure 801


RESULTS OF VOR AND ILS SELF TESTS ARE NORMAL
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
IS FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
APPLY STANDARD G.S. CENTERING SIGNAL TO G.S. ANT. JACK
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS
MEASURE TUNING VOLTAGE AT PIN 23 OF TEST CONNECTOR (108.00 MHZ)
IS TUNING VOLTAGE APPROX 8.15 VDC
REPLACE VHF SYNTHESIZER
APPLY STANDARD G.S. CENTERING SIGNAL TO G.S. ANT. JACK
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS
51RV-2B OPERATION IS NORMAL
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
PERFORM INITIAL PROCEDURES IN PARA. 3
DEPRESS VOR TEST SWITCH
IS FLAG CURRENT MORE THAN 300 UAMPS
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
IS RMI AT 180 ±4° AND VOR DEVIATION 0 ±15 UAMPS
IS A "TO" INDICATION OBTAINED
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
DEPRESS ILS DN/R SWITCH
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (RIGHT)
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS VOR DEVIATION 0 ±15 UAMPS
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (DOWN)
DEPRESS ILS UP/L SWITCH
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (LEFT)
REPLACE VHF NAV RCVR PLANAR ASS'Y
APPLY STANDARD G.S. DEVIATION SIGNAL (DOWN) TO G.S. ANT. JACK
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (DOWN)
REPLACE VHF NAV RCVR PLANAR ASS'Y
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
IS G.S. FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (UP)
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
APPLY STANDARD LOC DEVIATION SIGNAL (RIGHT) TO VOR/LOC ANT. JACK
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (RIGHT)
REPLACE VHF NAV RCVR PLANAR ASS'Y
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS FLAG CURRENT MORE THAN 300 UAMPS
APPLY STANDARD LOC CENTERING SIGNAL TO VOR/LOC ANT. JACK
IS LOC FLAG CURRENT MORE THAN 300 UAMPS
APPLY AN RF SIGNAL WITH 1000 Hz MOD TO VOR/LOC ANT. JACK
IS AUDIO PRESENT AT RCVR AURAL OUTPUT
MEASURE 2-KHZ SIGNAL AT PIN 30 OF TEST CONNECTOR
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS 2-KHZ SIGNAL APPROX. 25 VOLTS, P-P
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
TPO-4717-014

51RV-2B Troubleshooting Chart
Figure 801


PERFORM INITIAL PROCEDURES IN PARA. 3
DEPRESS VOR TEST SWITCH
IS FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
IS RMI AT 180 ±4° AND VOR DEVIATION 0 ±15 UAMPS
YES
NO
IS FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
IS A "TO" INDICATION OBTAINED
NO
APPLY STANDARD VOR CENTERING SIGNAL TO VOR/LOC ANT. JACK
APPLY STANDARD LOC CENTERING SIGNAL TO VOR/LOC ANT. JACK
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
REPLACE VHF NAV RCVR PLANAR ASS'Y
IS LOC FLAG CURRENT MORE THAN 300 UAMPS
YES
NO
NO
REPLACE VHF NAV RCVR PLANAR ASS'Y
YES
IS VOR DEVIATION 0 ±15 UAMPS
NO
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
APPLY AN RF SIGNAL WITH 1000 Hz MOD TO VOR/LOC ANT. JACK
IS AUDIO PRESENT AT RCVR AURAL OUTPUT
YES
NO
APPLY STANDARD LOC DEVIATION SIGNAL (RIGHT) TO VOR/LOC ANT. JACK
MEASURE 2-KHZ SIGNAL AT PIN 30 OF TEST CONNECTOR
REPLACE VHF NAV RCVR PLANAR ASS'Y
NO
IS LOC FLAG CURRENT MORE THAN 300 UAMPS AND DEV 75 ±5 UAMPS (RIGHT)
YES
NO
IS 2-KHZ SIGNAL APPROX. 25 VOLTS, P-P
YES
NO
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
REPLACE VHF NAV RCVR PLANAR ASS'Y
REPLACE VOR/LOC INSTRUMENTATION PLANAR ASS'Y
REPLACE GLIDE SLOPE RECEIVER PLANAR ASS'Y
TPO-4717-014

The initial procedures shown in figure 801 pertain to the results obtained when the 51RV-2B self-test switches are actuated (tests 8.0 and 24.0 of figure 704).

NOTE: The results shown for flag current are those required for flag-out-of-view indications and occur approximately 3 seconds after a self-test switch is actuated. The normal deviation indications are also those obtained after approximately 3 seconds.

Ensure that the frequency of the control unit and the signal generator correspond to the test. When an ILS test is made, the frequency of operation should be 110.10 MHz. When a VOR test is made, the frequency should be 114.90 MHz. Unless otherwise specified, the 479V-3 track selector is to be set at 180 degrees.

PAGE	REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	INTERCONNECT UNIT EFFECTIVITY

51RV-2B Interconnect Unit, Schematic Diagram (Sheet A)
Figure 802

NOTES:

(1) ALL WIRE DESIGNATED BY NOTE (1) IS TO BE DOUBLE-SHIELDED COAX.

(2) TP DESIGNATES TOP PLUG AND BP DESIGNATES BOTTOM PLUG.
MAIN CONNECTOR: CANNON DPX2-CA-32W2P57P-348, COLLINS PART NUMBER 370-5233-00.
MATING CONNECTOR: CANNON DPX2-CA-32W2S57S-33B, COLLINS PART NUMBER 370-5299-00.

(3) THE TEST CONNECTOR IS DESIGNATED P2.
P2 MAIN CONNECTOR: CANNON DPAF-32-34S, COLLINS PART NUMBER 370-2451-010.
P2 MATING CONNECTOR: CANNON DPA-32-33P, COLLINS PART NUMBER 370-2451-020

(4) MAIN CONNECTOR: COLLINS PART NUMBER 777-0622-001.
MATING CONNECTOR: COLLINS PART NUMBER 777-0621-001.

(5) MAIN CONNECTOR: COLLINS PART NUMBER 772-0700-001.
MATING CONNECTOR: COLLINS PART NUMBER 772-0626-001.

(6) MAIN CONNECTOR: COLLINS PART NUMBER 772-0698-001.
MATING CONNECTOR: COLLINS PART NUMBER 772-0718-001.

(7) MAIN CONNECTOR: COLLINS PART NUMBER 772-0699-001.
MATING CONNECTOR: COLLINS PART NUMBER 768-9098-001.

(8) PIN FUNCTIONS NOT REQUIRED FOR 51RV-2B OPERATION.

(9) A VERTICAL CONNECTOR ATTACHED TO THE REAR OF EACH PLANAR ASSEMBLY, AND DESIGNATED P1,

51RV-2B Interconnect Unit, Schematic Diagram (Sheet 1 of 3)
Figure 802

MATES WITH THE RESPECTIVE PLANAR ASSEMBLY CONNECTOR IN THE INTERCONNECT UNIT, DESIGNATED J1 THROUGH J4.

(10) THE WIRES BETWEEN J3-54 AND J4-53, AND BETWEEN J2-48 AND J4-17 ARE REMOVED ON THE INTERCONNECT UNIT WITH COLLINS PART NUMBER 772-0824-002.

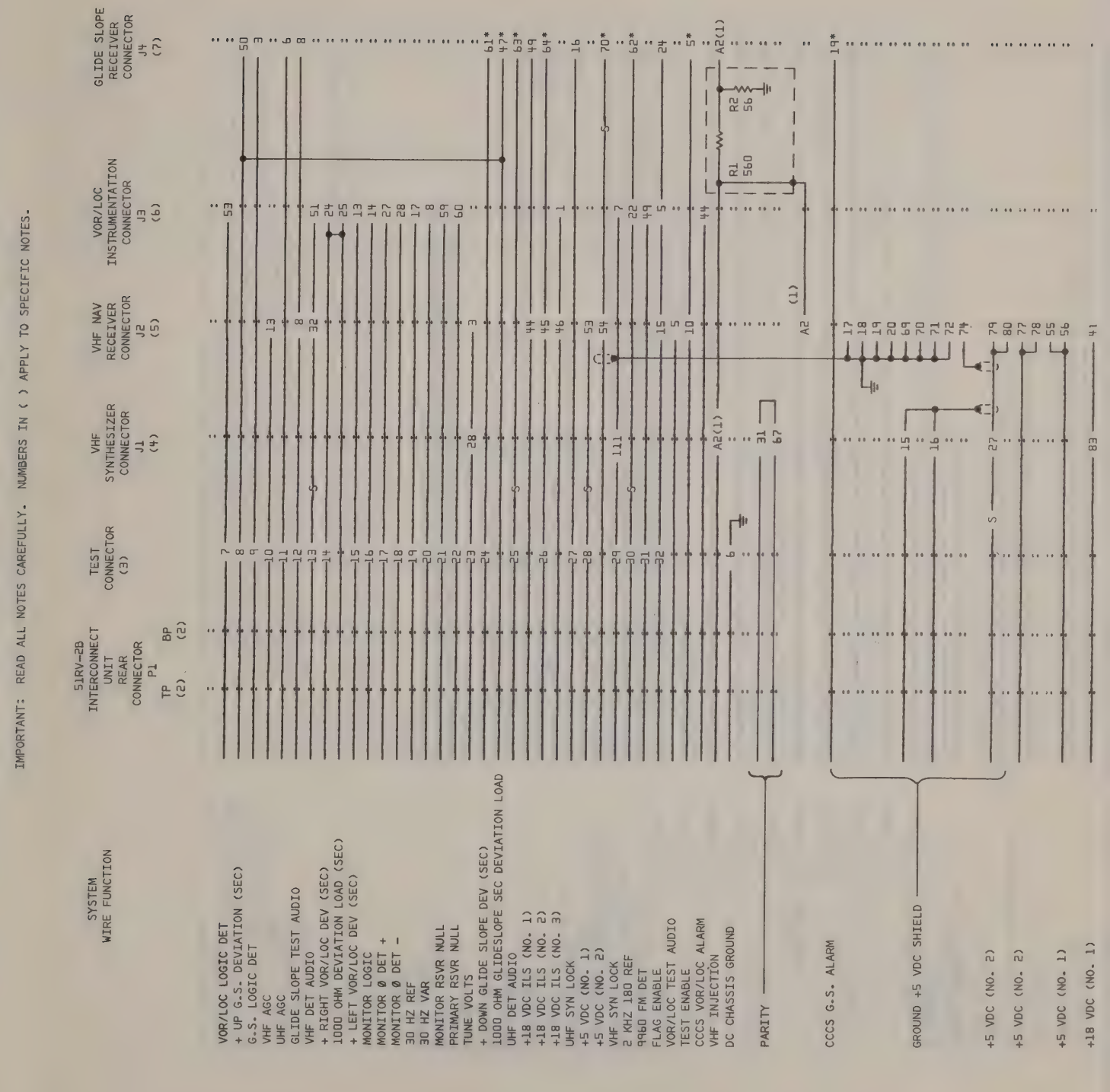
LEGEND:

1. S▽ REFERS TO SHIELDED-TWISTED PAIR. SHIELD IS TO HAVE AN INSULATING JACKET. ALL SHIELDS FOR A. S△ GIVEN CIRCUITS ARE TO BE GROUNDED AT ONE END ONLY.

2. ▽ X △ REFERS TO TRIPLE-TWISTED WIRE, NOT SHIELDED.

3. S REFERS TO SINGLE-SHIELDED WIRE.

4. * INDICATES TEST POINTS.



51RV-2B Interconnect Unit, Schematic Diagram (Sheet 2 of 3)
Figure 802

MATES WITH THE RESPECTIVE PLANAR ASSEMBLY CONNECTOR IN THE INTERCONNECT UNIT, DESIGNATED J1 THROUGH J4.

(10) THE WIRES BETWEEN J3-54 AND J4-53, AND BETWEEN J2-48 AND J4-17 ARE REMOVED ON THE INTERCONNECT UNIT WITH COLLINS PART NUMBER 772-0824-002.

LEGEND:

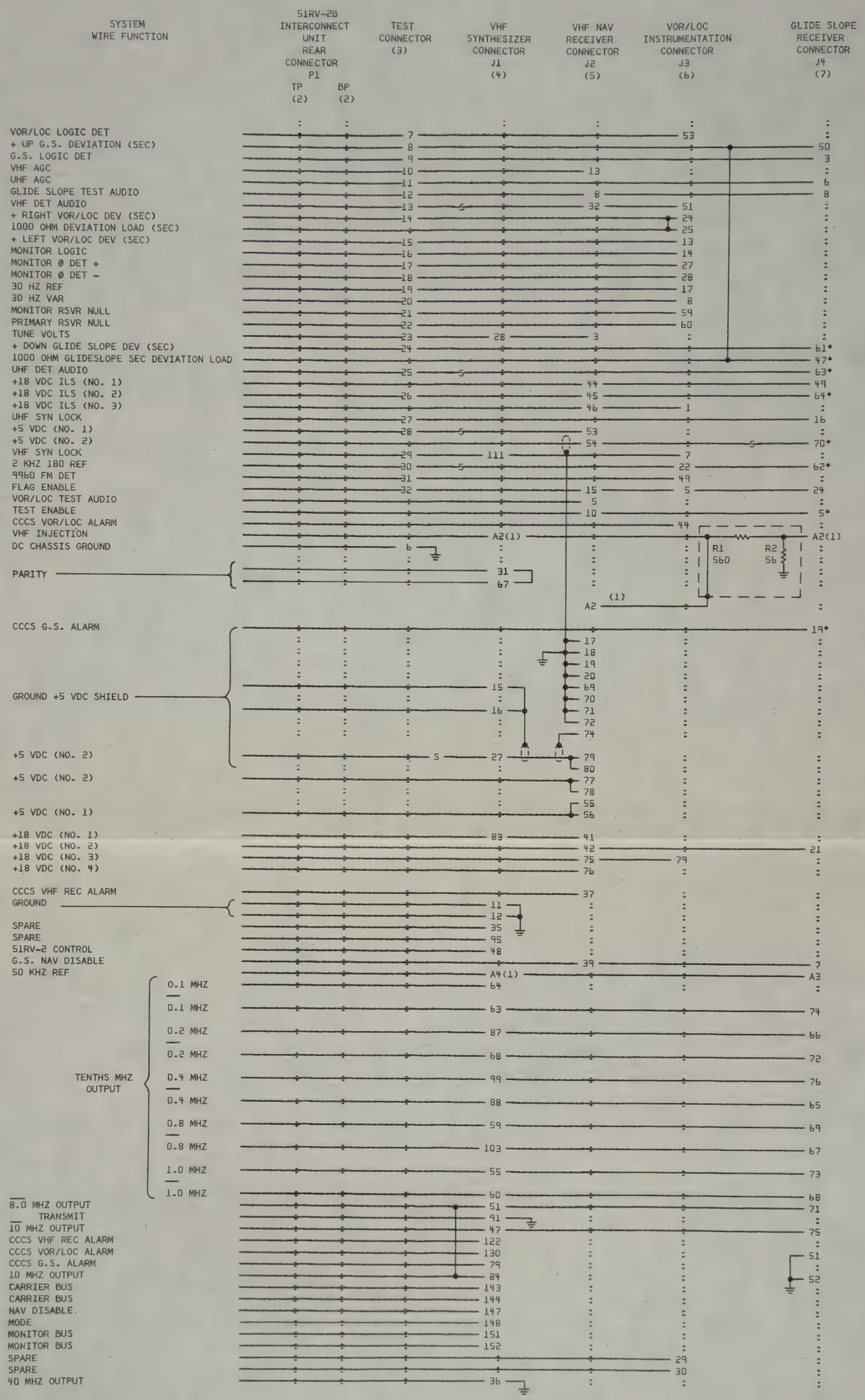
1. S▽ REFERS TO SHIELDED-TWISTED PAIR. SHIELD IS TO HAVE AN INSULATING JACKET. ALL SHIELDS FOR A. S△ GIVEN CIRCUITS ARE TO BE GROUNDED AT ONE END ONLY.

2. ▽ X △ REFERS TO TRIPLE-TWISTED WIRE, NOT SHIELDED.

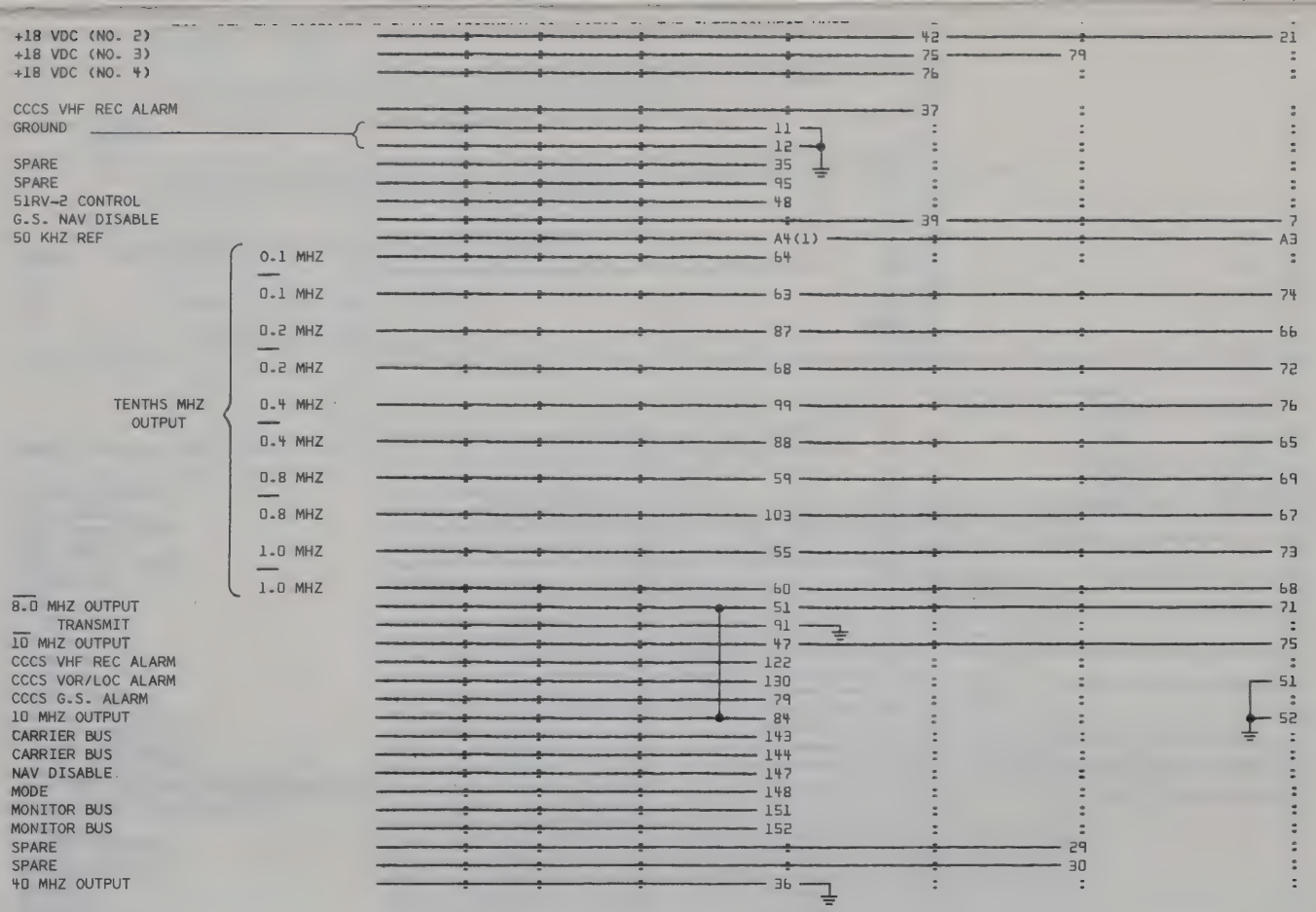
3. S REFERS TO SINGLE-SHIELDED WIRE.

4. * INDICATES TEST POINTS.

IMPORTANT: READ ALL NOTES CAREFULLY. NUMBERS IN ( ) APPLY TO SPECIFIC NOTES.

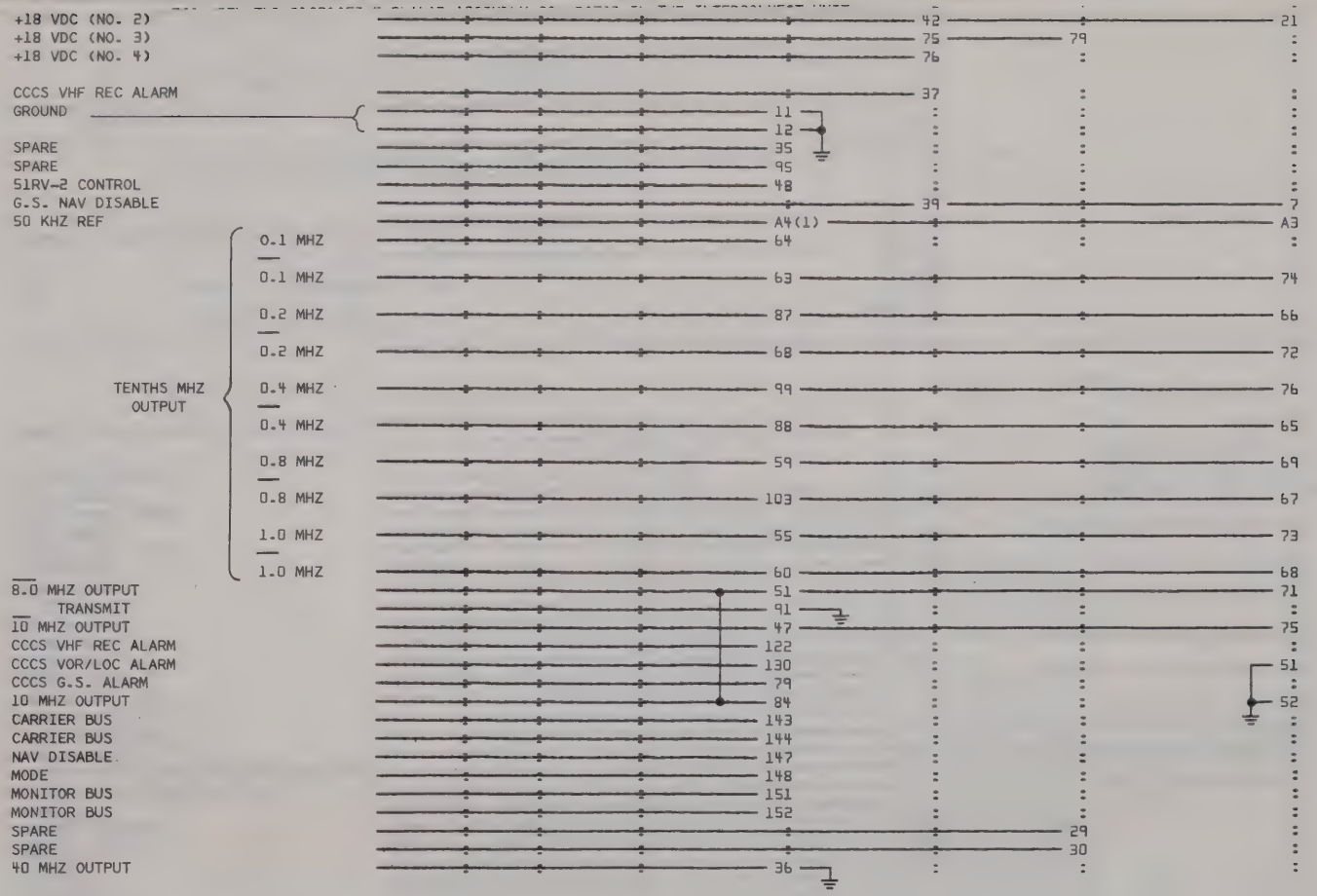


51RV-2B Interconnect Unit, Schematic Diagram (Sheet 2 of 3)
Figure 802

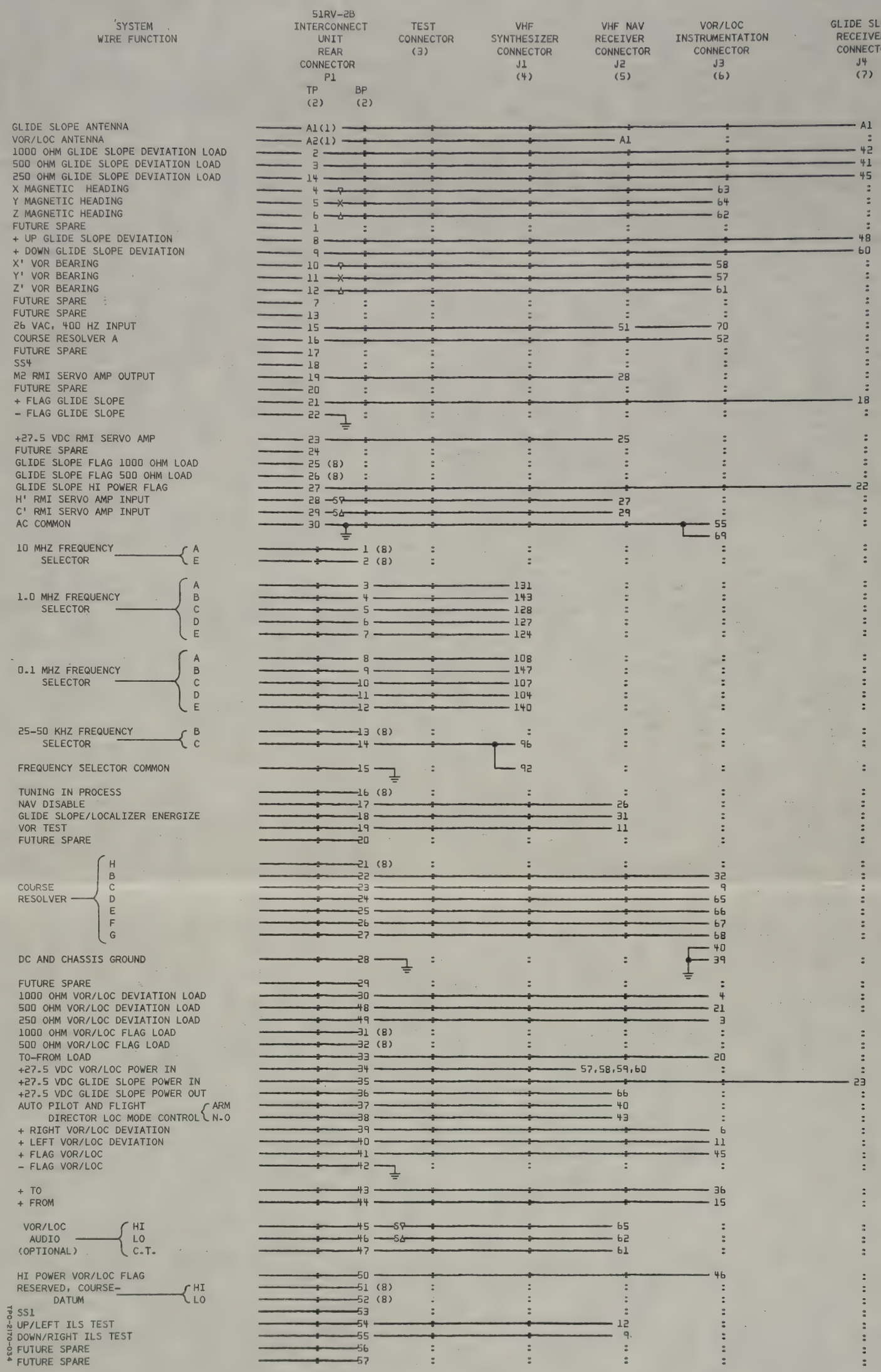

+18 VDC (NO. 2)
+18 VDC (NO. 3)
+18 VDC (NO. 4)
CCCS VHF REC ALARM
GROUND
SPARE
SPARE
51RV-2 CONTROL
G.S. NAV DISABLE
50 KHZ REF
TENTHS MHZ OUTPUT
0.1 MHZ
0.1 MHZ
0.2 MHZ
0.2 MHZ
0.4 MHZ
0.4 MHZ
0.8 MHZ
0.8 MHZ
1.0 MHZ
1.0 MHZ
8.0 MHZ OUTPUT TRANSMIT
10 MHZ OUTPUT
CCCS VHF REC ALARM
CCCS VOR/LOC ALARM
CCCS G.S. ALARM
10 MHZ OUTPUT
CARRIER BUS
CARRIER BUS
NAV DISABLE
MODE
MONITOR BUS
MONITOR BUS
SPARE
SPARE
40 MHZ OUTPUT
42
75
76
37
11
12
35
95
48
39
A4(1)
64
63
87
68
99
88
59
103
55
60
51
91
47
122
130
79
84
143
144
147
148
151
152
29
30
36
21
79
7
A3
74
66
72
76
65
69
67
73
68
71
75
51
52

IMPORTANT: READ ALL NOTES CAREFULLY- NUMBERS IN ( ) APPLY TO SPECIFIC NOTES.
SYSTEM WIRE FUNCTION
51RV-2B INTERCONNECT UNIT REAR CONNECTOR P1 TP (2) BP (2)
TEST CONNECTOR (3)
VHF SYNTHESIZER CONNECTOR J1 (4)
VHF NAV RECEIVER CONNECTOR J2 (5)
VOR/LOC INSTRUMENTATION CONNECTOR J3 (6)
GLIDE SLOPE RECEIVER CONNECTOR J4 (7)
GLIDE SLOPE ANTENNA
VOR/LOC ANTENNA
1000 OHM GLIDE SLOPE DEVIATION LOAD
500 OHM GLIDE SLOPE DEVIATION LOAD
250 OHM GLIDE SLOPE DEVIATION LOAD
X MAGNETIC HEADING
Y MAGNETIC HEADING
Z MAGNETIC HEADING
FUTURE SPARE
+ UP GLIDE SLOPE DEVIATION
+ DOWN GLIDE SLOPE DEVIATION
X' VOR BEARING
Y' VOR BEARING
Z' VOR BEARING
FUTURE SPARE
FUTURE SPARE
26 VAC, 400 HZ INPUT
COURSE RESOLVER A
FUTURE SPARE
SS4
M2 RMI SERVO AMP OUTPUT
FUTURE SPARE
+ FLAG GLIDE SLOPE
- FLAG GLIDE SLOPE
+27.5 VDC RMI SERVO AMP
FUTURE SPARE
GLIDE SLOPE FLAG 1000 OHM LOAD
GLIDE SLOPE FLAG 500 OHM LOAD
GLIDE SLOPE HI POWER FLAG
H' RMI SERVO AMP INPUT
C' RMI SERVO AMP INPUT
AC COMMON
10 MHZ FREQUENCY SELECTOR
1.0 MHZ FREQUENCY SELECTOR
0.1 MHZ FREQUENCY SELECTOR
25-50 KHZ FREQUENCY SELECTOR
FREQUENCY SELECTOR COMMON
TUNING IN PROCESS
NAV DISABLE
GLIDE SLOPE/LOCALIZER ENERGIZE
VOR TEST
FUTURE SPARE

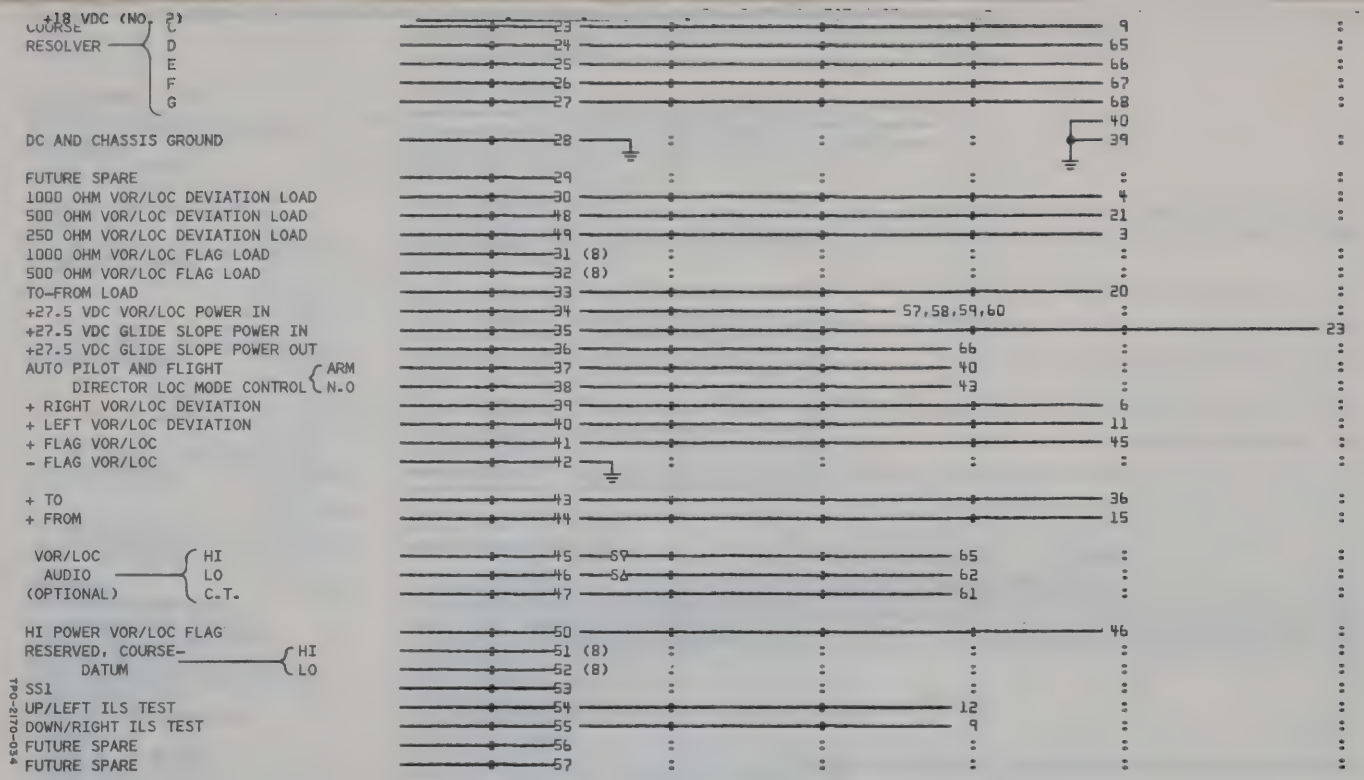
51RV-2B Interconnect Unit, Schematic Diagram (Sheet 3 of 3)
Figure 802


+18 VDC (NO. 2)
+18 VDC (NO. 3)
+18 VDC (NO. 4)
CCCS VHF REC ALARM
GROUND
SPARE
SPARE
51RV-2 CONTROL
G.S. NAV DISABLE
50 KHZ REF
TENTHS MHZ OUTPUT
0.1 MHZ
0.1 MHZ
0.2 MHZ
0.2 MHZ
0.4 MHZ
0.4 MHZ
0.8 MHZ
0.8 MHZ
1.0 MHZ
1.0 MHZ
8.0 MHZ OUTPUT
TRANSMIT
10 MHZ OUTPUT
CCCS VHF REC ALARM
CCCS VOR/LOC ALARM
CCCS G.S. ALARM
10 MHZ OUTPUT
CARRIER BUS
CARRIER BUS
NAV DISABLE
MODE
MONITOR BUS
MONITOR BUS
SPARE
SPARE
40 MHZ OUTPUT
42
21
75
79
76
37
11
12
35
95
48
39
7
A4(1)
A3
64
63
74
87
66
68
72
99
76
88
65
59
69
103
67
55
73
60
68
51
71
91
47
75
122
130
51
79
84
52
143
144
147
148
151
152
29
30
36

IMPORTANT: READ ALL NOTES CAREFULLY. NUMBERS IN ( ) APPLY TO SPECIFIC NOTES.


SYSTEM WIRE FUNCTION
51RV-2B INTERCONNECT UNIT REAR CONNECTOR P1
TP (2)
BP (2)
TEST CONNECTOR (3)
VHF SYNTHESIZER CONNECTOR J1 (4)
VHF NAV RECEIVER CONNECTOR J2 (5)
VOR/LOC INSTRUMENTATION CONNECTOR J3 (6)
GLIDE SLOPE RECEIVER CONNECTOR J4 (7)
GLIDE SLOPE ANTENNA
VOR/LOC ANTENNA
1000 OHM GLIDE SLOPE DEVIATION LOAD
500 OHM GLIDE SLOPE DEVIATION LOAD
250 OHM GLIDE SLOPE DEVIATION LOAD
X MAGNETIC HEADING
Y MAGNETIC HEADING
Z MAGNETIC HEADING
FUTURE SPARE
+ UP GLIDE SLOPE DEVIATION
+ DOWN GLIDE SLOPE DEVIATION
X' VOR BEARING
Y' VOR BEARING
Z' VOR BEARING
FUTURE SPARE
FUTURE SPARE
26 VAC, 400 HZ INPUT
COURSE RESOLVER A
FUTURE SPARE
SS4
M2 RMI SERVO AMP OUTPUT
FUTURE SPARE
+ FLAG GLIDE SLOPE
- FLAG GLIDE SLOPE
+27.5 VDC RMI SERVO AMP
FUTURE SPARE
GLIDE SLOPE FLAG 1000 OHM LOAD
GLIDE SLOPE FLAG 500 OHM LOAD
GLIDE SLOPE HI POWER FLAG
H' RMI SERVO AMP INPUT
C' RMI SERVO AMP INPUT
AC COMMON
10 MHZ FREQUENCY SELECTOR A E
1.0 MHZ FREQUENCY SELECTOR A B C D E
0.1 MHZ FREQUENCY SELECTOR A B C D E
25-50 KHZ FREQUENCY SELECTOR B C
FREQUENCY SELECTOR COMMON
TUNING IN PROCESS
NAV DISABLE
GLIDE SLOPE/LOCALIZER ENERGIZE
VOR TEST
FUTURE SPARE
COURSE RESOLVER H B C D E F G
DC AND CHASSIS GROUND
FUTURE SPARE
1000 OHM VOR/LOC DEVIATION LOAD
500 OHM VOR/LOC DEVIATION LOAD
250 OHM VOR/LOC DEVIATION LOAD
1000 OHM VOR/LOC FLAG LOAD
500 OHM VOR/LOC FLAG LOAD
TO-FROM LOAD
+27.5 VDC VOR/LOC POWER IN
+27.5 VDC GLIDE SLOPE POWER IN
+27.5 VDC GLIDE SLOPE POWER OUT
AUTO PILOT AND FLIGHT DIRECTOR LOC MODE CONTROL ARM N-O
+ RIGHT VOR/LOC DEVIATION
+ LEFT VOR/LOC DEVIATION
+ FLAG VOR/LOC
- FLAG VOR/LOC
+ TO
+ FROM
VOR/LOC AUDIO (OPTIONAL) HI LO C.T.
HI POWER VOR/LOC FLAG
RESERVED, COURSE-DATUM HI LO
SS1
UP/LEFT ILS TEST
DOWN/RIGHT ILS TEST
FUTURE SPARE
FUTURE SPARE
TP-2-170-034

51RV-2B Interconnect Unit, Schematic Diagram (Sheet 3 of 3)
Figure 802


+18 VDC (NO. 2)
COURSE RESOLVER
C
D
E
F
G
DC AND CHASSIS GROUND
FUTURE SPARE
1000 OHM VOR/LOC DEVIATION LOAD
500 OHM VOR/LOC DEVIATION LOAD
250 OHM VOR/LOC DEVIATION LOAD
1000 OHM VOR/LOC FLAG LOAD
500 OHM VOR/LOC FLAG LOAD
TO-FROM LOAD
+27.5 VDC VOR/LOC POWER IN
+27.5 VDC GLIDE SLOPE POWER IN
+27.5 VDC GLIDE SLOPE POWER OUT
AUTO PILOT AND FLIGHT DIRECTOR LOC MODE CONTROL
ARM
N.O
+ RIGHT VOR/LOC DEVIATION
+ LEFT VOR/LOC DEVIATION
+ FLAG VOR/LOC
- FLAG VOR/LOC
+ TO
+ FROM
VOR/LOC AUDIO (OPTIONAL)
HI
LO
C.T.
HI POWER VOR/LOC FLAG
RESERVED, COURSE-DATUM
HI
LO
SS1
UP/LEFT ILS TEST
DOWN/RIGHT ILS TEST
FUTURE SPARE
FUTURE SPARE
23
24
25
26
27
28
29
30
48
49
31 (8)
32 (8)
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
50
51 (8)
52 (8)
53
54
55
56
57
9
65
66
67
68
40
39
4
21
3
20
57,58,59,60
23
66
40
43
6
11
45
36
15
S9
SA
65
62
61
46
12
9

T40-210-030

51RV-2B VOR/ILS Receiver - Storage Instructions

1. GENERAL.

This section presents storage instructions for the 51RV-2B VOR/ILS Receiver. Ensure that all cards are secured to the chassis and that all planar assemblies are installed in the dust covers. If the 51RV-2B is to be stored for a long time, then place the 51RV-2B in the original shipping carton. Wrap the 51RV-2B in a plastic bag with two or more 16-unit bags of desiccant, and heat-seal the opening.

51RV-2B VOR/ILS Receiver - Special Tools, Fixtures, and Test Equipment

1. GENERAL.

This section presents a list of special tools, fixtures, and test equipment required to test or overhaul the 51RV-2B VOR/ILS Receiver.

2. TEST EQUIPMENT REQUIRED.

Figure 1001 lists the equipment required to test, troubleshoot, and overhaul the 51RV-2B. Any substitution of test equipment must be equivalent to, or better than, that which is listed.

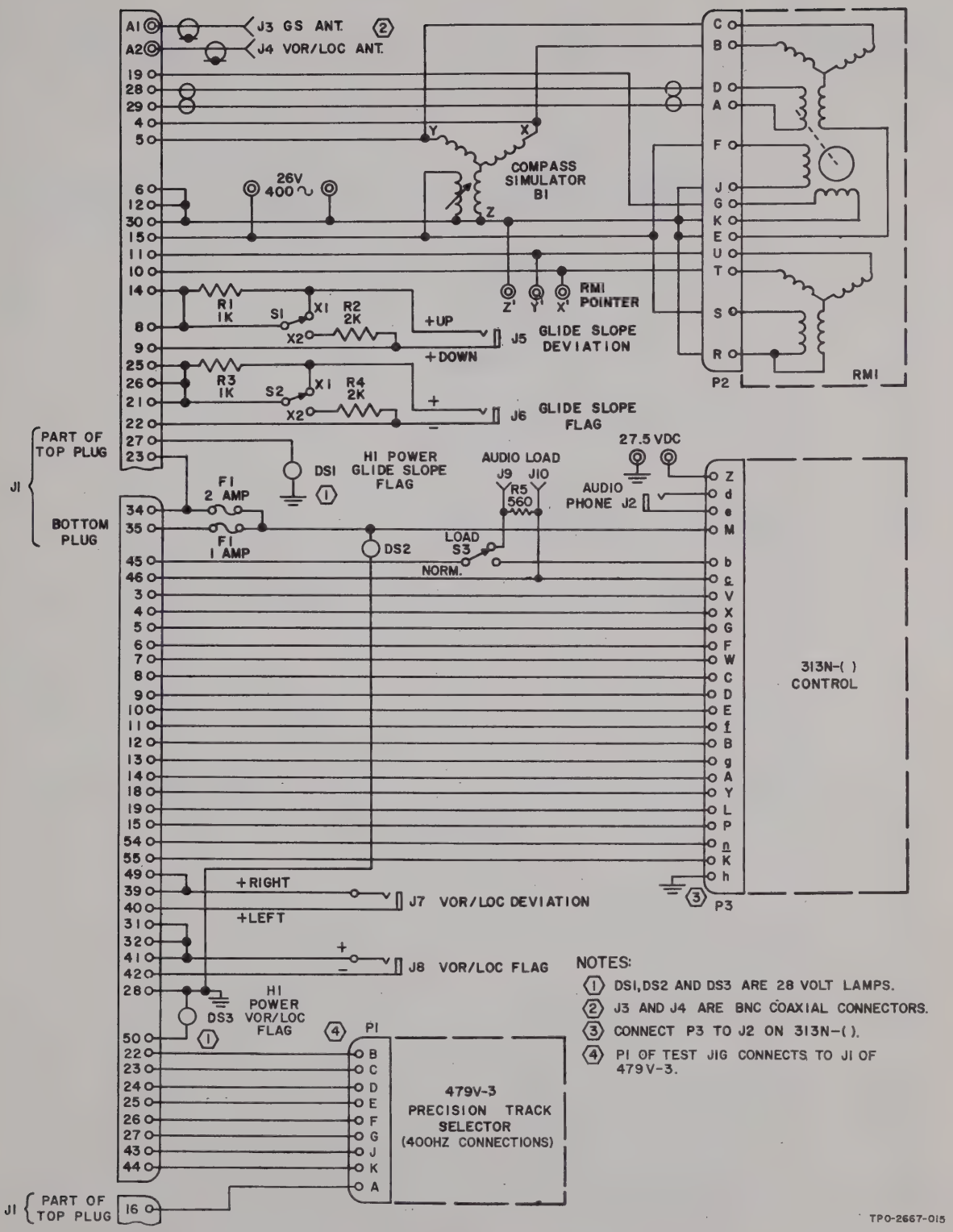
Figure 1002 is a schematic diagram of a suggested test fixture. The test fixture should be made for testing and troubleshooting the 51RV-2B.

EQUIPMENT	MANUFACTURER AND TYPE
51RV-2B test jig or 977A-1 Test Panel	To be locally fabricated (figure 1002) Collins part number 777-1356-001
Test connector adapter unit	To be locally fabricated (figure 1003) NOTE: The test connector adapter unit is used with the 51RV-2B test jig (figure 1002). The 51RV-2B test jig and the test connector adapter unit are not required if the 977A-1 Test Panel is used.
Vtvm (ac)	Ballantine 310A, 300, or Hewlett-Packard 400D or 400H
Vtvm (dc)	Hewlett-Packard 410B or 410C
Differential voltmeter	Fluke 801B
Audio signal generator	Collins 479S-3
Vhf signal generator	Boonton 211-A

Test Equipment Required (Sheet 1 of 2)
Figure 1001

EQUIPMENT	MANUFACTURER AND TYPE
Glideslope signal generator	Boonton 232-A
Precision track selector	Collins 479V-3
Oscilloscope	DuMont 304-A or Tektronix 315
6-db, 50-ohm pad and cable (included with 211-A and 232-A)	Boonton 505-B and 514-B
Deviation meter and flag meter	Hewlett-Packard 425-A
Power supply	+27.5 vdc regulated power supply

Test Equipment Required (Sheet 2 of 2)
Figure 1001



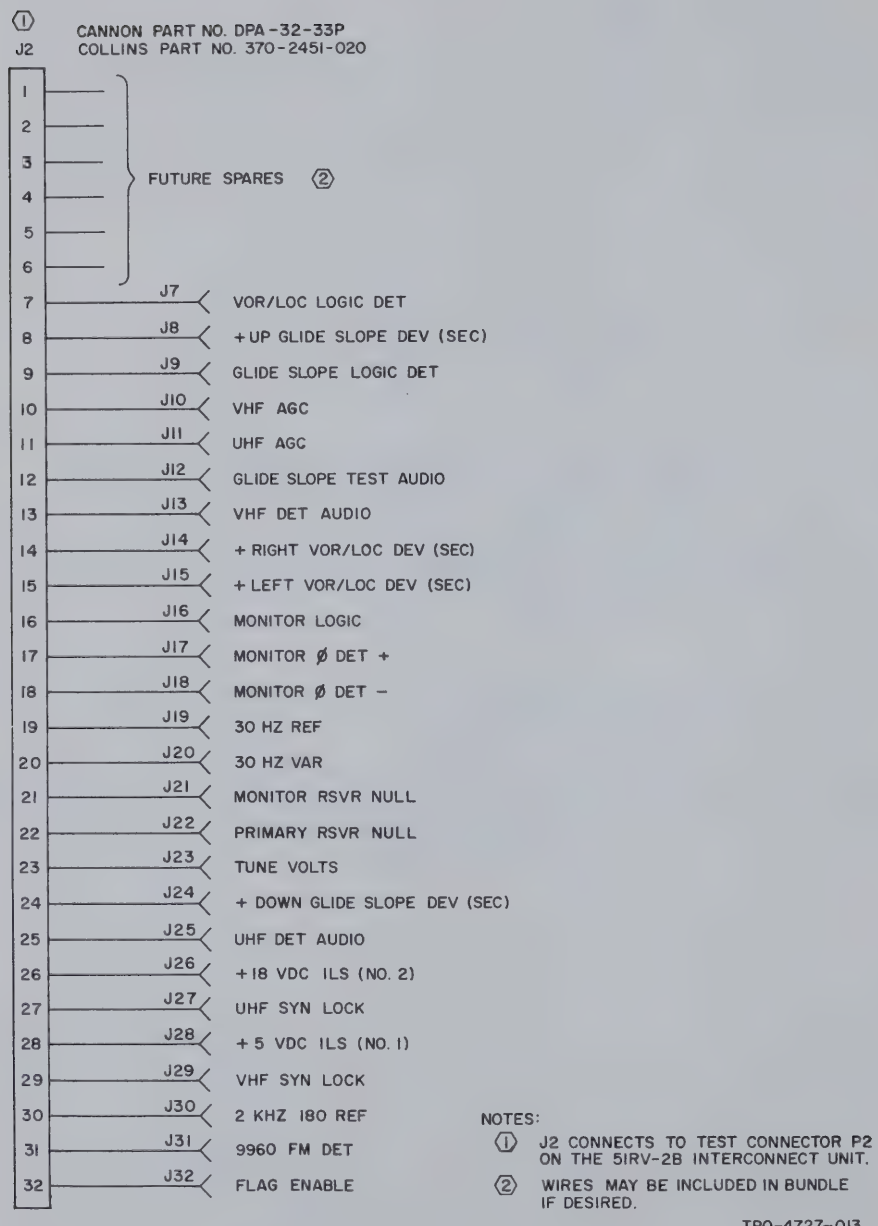
51RV-2B VOR/ILS Receiver Test Jig, Schematic Diagram (Sheet 1 of 3)
Figure 1002

REFERENCE DESIGNATION	COMPONENT	COLLINS PART NUMBER
B1	Synchro transmitter	229-0076-000
	Vernier dial for B1, Theta model DA-11-120	(Obtained from Theta Instrument Corp., 22 Spielman Road, Fairfield, New Jersey 07006.)
DS1	Lamp 28 volt (with socket)	
DS2	Lamp, 28 volt (with socket)	
DS3	Lamp, 28 volt (with socket)	
F1	Fuse, 2 A (with fuseholder)	
F2	Fuse, 1 A (with fuseholder)	
J1	Connector, Cannon part number DPX2-CA-32W2S7S-33B-0202	370-5229-00
	2 coaxial inserts for J1, Cannon part number 249-1390-000	370-5224-00
J2	Jack, phone	
J3	Jack, BNC	
J4	Jack, BNC	
J5	Jack, phone	
J6	Jack, phone	
J7	Jack, phone	
J8	Jack, phone	
J9	Jack, Johnson DF-30	
J10	Jack, Johnson DF-30	
Misc	7 banana or tip jacks	
P1	Connector, Scintilla PT06A-14-19S	371-8087-00

51RV-2B VOR/ILS Receiver Test Jig, Schematic Diagram (Sheet 2 of 3)
Figure 1002

REFERENCE DESIGNATION	COMPONENT	COLLINS PART NUMBER
P2	Connector, Amphenol AN3106-22-14S	357-4034-00
P3	Connector, Scintilla PT06A-20-41S	371-6200-00
R1	Resistor, 1000 ohms, 1/4 w, 1%	
R2	Resistor, 2000 ohms, 1/4 w, 1%	
R3	Resistor, 1000 ohms, 1/4 w, 1%	
R4	Resistor, 2000 ohms, 1/4 w, 1%	
R5	Resistor, 560 ohms, 1 w, 10%	
S1	Switch, SPDT (on-on)	
S2	Switch, SPDT (on-on)	
Misc	Wire, #20 AWG Teflon	
Misc	RMI	
Misc	Control, Collins 313N-( )	Listed in figure 3

51RV-2B VOR/ILS Receiver Test Jig, Schematic Diagram (Sheet 3 of 3)
Figure 1002


① J2
CANNON PART NO. DPA-32-33P
COLLINS PART NO. 370-2451-020
1
2
3
4
5
6
FUTURE SPARES ②
7 J7 VOR/LOC LOGIC DET
8 J8 +UP GLIDE SLOPE DEV (SEC)
9 J9 GLIDE SLOPE LOGIC DET
10 J10 VHF AGC
11 J11 UHF AGC
12 J12 GLIDE SLOPE TEST AUDIO
13 J13 VHF DET AUDIO
14 J14 + RIGHT VOR/LOC DEV (SEC)
15 J15 + LEFT VOR/LOC DEV (SEC)
16 J16 MONITOR LOGIC
17 J17 MONITOR Ø DET +
18 J18 MONITOR Ø DET −
19 J19 30 HZ REF
20 J20 30 HZ VAR
21 J21 MONITOR RSVR NULL
22 J22 PRIMARY RSVR NULL
23 J23 TUNE VOLTS
24 J24 + DOWN GLIDE SLOPE DEV (SEC)
25 J25 UHF DET AUDIO
26 J26 +18 VDC ILS (NO. 2)
27 J27 UHF SYN LOCK
28 J28 + 5 VDC ILS (NO. 1)
29 J29 VHF SYN LOCK
30 J30 2 KHZ 180 REF
31 J31 9960 FM DET
32 J32 FLAG ENABLE
NOTES:
① J2 CONNECTS TO TEST CONNECTOR P2 ON THE 51RV-2B INTERCONNECT UNIT.
② WIRES MAY BE INCLUDED IN BUNDLE IF DESIRED.
TPO-4727-013

Test Connector Adapter Unit, Schematic Diagram (Sheet 1 of 2)
Figure 1003

REFERENCE DESIGNATOR	COMPONENT	COLLINS PART NUMBER
J2	Connector, Cannon part number DOA-32-33P.	370-2451-020
J7 through J32	Jacks, banana or tip, various colors.	
Misc	5 x 10 x 2 inch aluminum chassis or 1/8 x 19 inch aluminum rack panel.	
Misc	Wire, #22 AWG Teflon.	

Test Connector Adapter Unit, Schematic Diagram (Sheet 2 of 2)
Figure 1003

51RV-2B VOR/ILS Receiver - Illustrated Parts List

INTRODUCTION

1. GENERAL.

This Illustrated Parts List is a complete list of parts for the above equipment manufactured by Collins Radio Company (see figure 1101).

Collins Radio Company part numbering system is comprised of a three-digit family number, a four-digit serial number, and two- or three-digit dash number:

FAMILY NO.	SERIAL NO.	DASH NO.
XXX	XXXX	XX or XXX

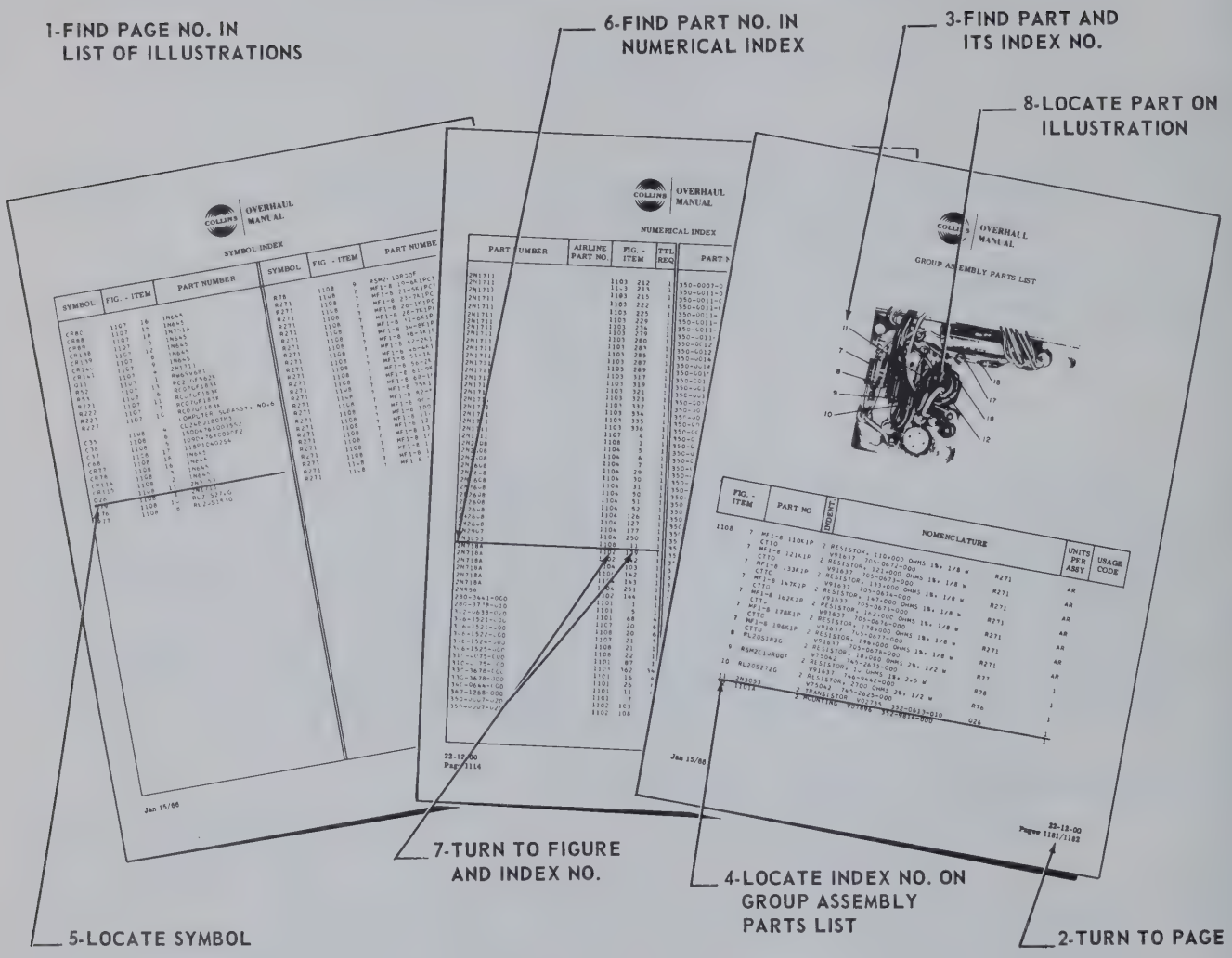
If a part is purchased by Collins Radio Company from a vendor, the Federal Manufacturer's Code Number is listed in the nomenclature column. If this column does not include a Federal Manufacturer's Code Number, the item is either a MIL approved item, commercial item or manufactured by Collins. Where COML appears in this column, the part may be obtained commercially from various vendors. Part numbers appearing in this column are Collins assigned part numbers for that item. Serial numbers or MCN (manufacturing control number) effectivities, where applicable, are listed in this column. Serial number effectivities are designated on the nameplate. The MCN is stamped on each module and/or chassis. Changes made from service bulletins are so indicated by SB1, SB2, etc.

2. MANUFACTURER'S CODE AND NAME INDEX.

CODE	MANUFACTURER'S NAME AND ADDRESS
05973	Haveg Super-Temperature Wires West Canal St. Winooski, Vt. 05404
71468	ITT Cannon Electric, Inc. 3208 Humbolt St. Los Angeles, Calif. 90031
72962	Elastic Stop Nut Corp. of America 2330 Vauxhall Rd. Union, N. J. 07083
73957	Groov-Pin Corp. 1125 Hendricks Causeway Ridgefield, N. J. 07657
75237	Kaynar Mfr. Co. Pico-Rivera, Calif. 90660
77250	Pheoll Mfr. Co. 5700 Roosevelt Rd. Chicago, Ill. 60650
78189	Shakeproof Division of Illinois Tool Works, Inc. St. Charles Rd. Elgin, Ill. 60120
98291	Sealectro Corp. 225 Hoyt Mamaroneck, N. Y. 10544

INTRODUCTION

How to Use This Illustrated Parts List


1-FIND PAGE NO. IN LIST OF ILLUSTRATIONS
6-FIND PART NO. IN NUMERICAL INDEX
3-FIND PART AND ITS INDEX NO.
8-LOCATE PART ON ILLUSTRATION
7-TURN TO FIGURE AND INDEX NO.
4-LOCATE INDEX NO. ON GROUP ASSEMBLY PARTS LIST
5-LOCATE SYMBOL
2-TURN TO PAGE

HOW TO FIND THE PART NUMBER IF THE SECTION OR SYSTEM OF THE EQUIPMENT IN WHICH THE PART IS USED IS KNOWN:

(1) Turn to the List of Illustrations and find the page number for the Major Assembly or System in which the part is used.

(2) Turn to the page determined in step (1).

(3) Locate the part and its index number on the illustration.

(4) Find the index number on the Group Assembly Parts List page to determine complete description.

(5) If the reference designation symbol is known, refer to the Symbol Index to find the part number.

HOW TO FIND THE ILLUSTRATION FOR A PART IF THE PART NUMBER IS KNOWN:

(6) Refer to the Numerical Index and find the part number.

(7) Turn to the Group Assembly Parts List and find the first figure and index number indicated in the Numerical Index for that part. If this figure shows the part in a section or system of the equipment other than the one desired, refer to the other figure numbers listed in the Numerical Index.

(8) On the face of the illustration, find the index number determined in step (7).

NUMERICAL INDEX

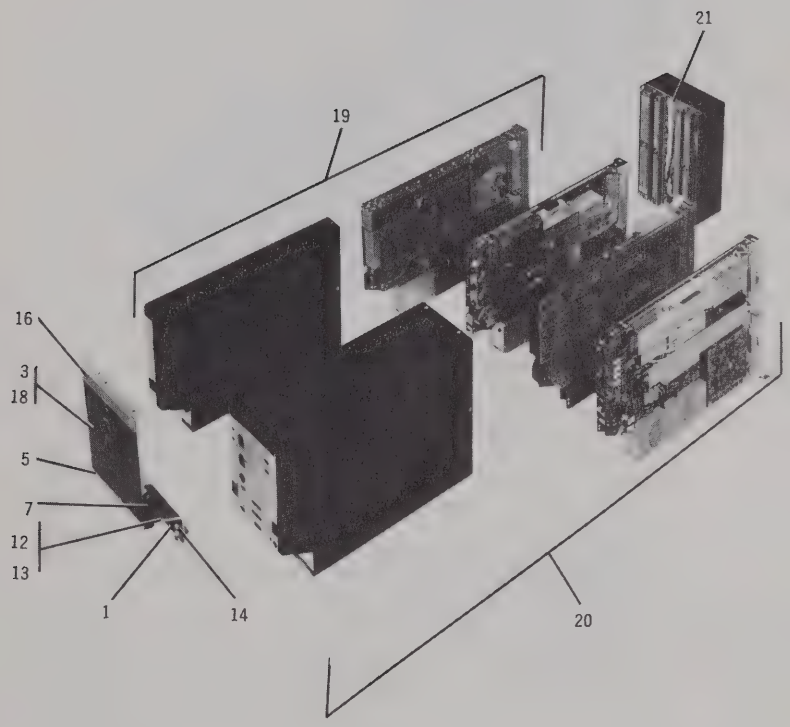
PART NUMBER	FIG. - ITEM	TTL REQ	AIRLINE PART NO.
AN50110-32	1103 43	3	
DPAF32-34S	1103 18	1	
DPA60	1103 17	1	
DPX2CA32W2P57P34B0002	1103 12	1	
F12NKCFM2-62	1103 9	8	
GP1-062X187-50	1101 6	2	
K1913-06	1101 16	4	
MS20426AD2-3	1102 8	4	
MS20426AD2-3	1102 16	4	
MS20426AD2-3	1102 24	4	
MS20426AD2-35	1102 4	12	
MS20426AD2-35	1102 12	6	
MS20426AD2-35	1102 20	10	
MS20426AD2-4	1102 9	1	
MS20426AD2-4	1102 17	1	
MS20426AD2-4	1102 25	1	
MS20426AD3-4	1101 17	8	
MS20426AD5-7	1101 15	4	
MS21042-06	1101 8	2	
MS35338-135	1103 23	1	
MS35338-137	1103 35	3	
MS35649-44	1103 22	1	
MS51957-1	1103 29	2	
MS51957-13	1103 10	16	
MS51959-3	1103 20	4	
030-1918-000	1103 38	175	
P330-2291-000	1103 15	3	
P330-2292-000	1103 16	1	
P330-4058-020	1101 4	6	
P330-4058-020	1102 2	6	
P330-4058-020	1103 6	8	
P342-0500-000	1103 25	1	
P347-1268-000	1101 2	2	
RC07GF560K	1103 27	1	
RC07GF561K	1103 26	1	
TF305	1103 28	2	
031-1067-001	1103 37	3	
2104-C8-02-252ON	1103 33	1	
310-0070-000	1103 30	2	
310-0278-000	1103 11	16	
310-0724-000	1102 10	1	
310-0724-000	1102 18	1	
310-0724-000	1102 26	1	
425-1601-000	1103 31	AR	
522-4280-001	1101 0	1	
522-4977-001	1101 0	1	
541-5989-002	1103 24	1	
544-8678-002	1103 34	3	
549-6138-002	1103 13	1	
757-0700-001	1102 30	1	
757-0701-001	1102 29	1	

PART NUMBER	FIG. - ITEM	TTL REQ	AIRLINE PART NO.
757-0709-001	1103 1	1	
757-4981-001	1101 1	1	
757-9787-001	1101 1	1	
761-5187-001	1101 13	2	
768-1379-001	1103 36	1	
768-3178-001	1101 10	4	
768-3179-001	1101 11	2	
768-3284-001	1101 9	2	
768-3430-002	1103 42	3	
768-3431-001	1103 41	3	
768-3432-003	1103 40	3	
768-3435-001	1103 7	6	
768-3435-002	1103 8	2	
768-3436-001	1101 14	2	
768-5070-001	1103 32	3	
768-5734-008	1101 12	1	
768-7250-001	1101 5	1	
768-7266-001	1101 7	1	
768-7268-002	1102 21	1	
768-7269-001	1102 5	1	
768-7269-002	1102 13	1	
768-7270-002	1102 22	1	
768-7271-001	1102 6	1	
768-7271-002	1102 14	1	
768-7272-001	1102 7	1	
768-7272-001	1102 15	1	
768-7272-001	1102 23	1	
768-8723-001	1103 39	1	
768-9028-001	1102 19	2	
768-9029-001	1102 3	2	
768-9030-001	1102 11	1	
772-0698-001	1103 4	1	
772-0699-001	1103 5	1	
772-0700-001	1103 3	1	
772-0738-001	1101 19	1	
772-0790-001	1102 28	1	
772-0824-001	1101 21	1	
772-0824-001	1103 0	REF	
772-0824-002	1101 21	1	
772-0824-002	1103 0	REF	
772-0825-001	1101 3	1	
772-0880-001	1101 18	1	
772-4765-001	1101 20	1	
772-4765-001	1102 0	REF	
772-4766-001	1102 27	1	
772-8704-001	1103 21	1	
777-0103-001	1102 1	1	
777-0622-001	1103 2	1	
92-1660-26	1103 19	4	
92-1660-40	1103 14	3	

SYMBOL INDEX

SYMBOL	FIG. - ITEM	PART NUMBER
J1	1103 2	777-0622-001
J2	1103 3	772-0700-001
J3	1103 4	772-0698-001
J4	1103 5	772-0699-001
P1	1103 12	DPX2CA32W2P57P34B0002
P2	1103 18	DPAF32-34S
R1	1103 26	RC07GF561K
R2	1103 27	RC07GF560K

GROUP ASSEMBLY PARTS LIST

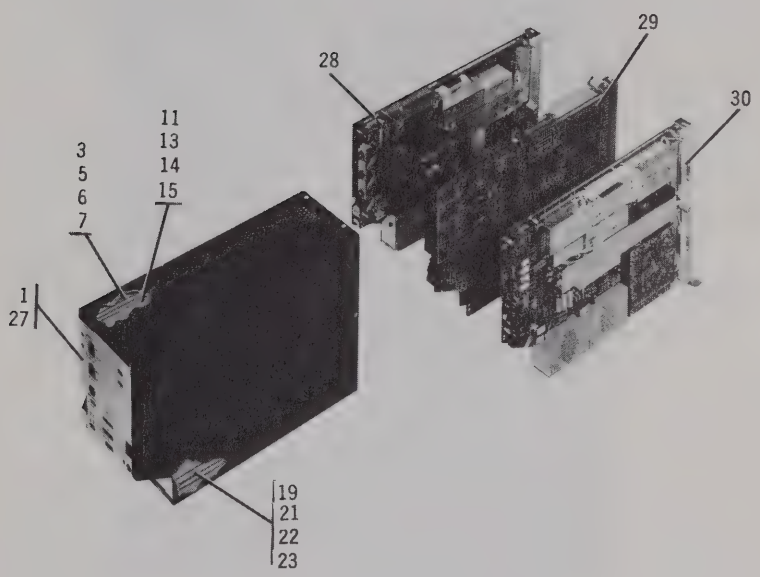


51RV-2B VOR/ILS Receiver
Figure 1101

GROUP ASSEMBLY PARTS LIST

FIG. - ITEM	PART NO.	INDENT.	NOMENCLATURE	UNITS PER ASSY.	USAGE CODE
1101 - 0	522-4280-001	1	51RV-2B VOR/ILS RECEIVER	1	A
1101 - 0	522-4977-001	1	51RV-2B VOR/ILS RECEIVER	1	B
1	757-4981-001	2	PLATE, IDENT	1	A
1	757-9787-001	2	PLATE, IDENT	1	B
- 2	P347-1268-000	2	SCREW, MACH., SST, FIL H, 2-56 X 1/8 77250 347-1268-000 AP	2	
3	772-0825-001	2	PANEL	1	
- 4	P330-4058-020	2	SCREW, MACH., STL, FH, 6-32 X 5/16 77250 330-4058-020 AP	6	
5	768-7250-001	3	BAR, GRIP P	1	
- 6	GP1-062X187-50	3	PIN, GROOVED, HDLS, STL, 0.062 DIA X 0.1875 LG 73957 311-1120-300 AP	2	
7	768-7266-001	3	STRAP, HANDLE P	1	
- 8	MS21042-06	3	NUT, SELF-LKG, HEX., CAD. PL STL, 6-32 334-2737-010 AP	2	
- 9	768-3284-001	3	SLEEVE, SPACER AP	2	
- 10	768-3178-001	3	WASHER, SPL, HANDLE AP	4	
- 11	768-3179-001	3	SCREW, SPL AP	2	
12	768-5734-008	3	EXTRUSION	1	
13	761-5187-001	3	BUMPER, RUB.	2	
14	768-3436-001	3	HOOK, HOLD DOWN	2	
- 15	MS20426AD5-7	3	RIVET, SOLID, AL, 5/32 DIA X 7/16 LG SHK 305-1391-000 AP	4	
16	K1913-06	3	NUT, SELF-LKG, PLATE, CAD. PL STL, 6-32 75237 334-1033-000	4	
- 17	MS20426AD3-4	3	RIVET, SOLID, AL, FH, 3/32 DIA X 1/4 LG SHK 305-1362-000 AP	8	
18	772-0880-001	3	PANEL, FRONT P	1	
19	772-0738-001	2	680T-1 UHF SYNTHESIZER SEE COLLINS PUBLICATION 523-0759575-001113	1	
20	772-4765-001	2	GS/INSTRUMENTATION/RCVR ASSY SEE FIG. 1102	1	
21	772-0824-001	2	INTERCONNECT UNIT SEE FIG. 1103	1	
	772-0824-002	2	INTERCONNECT UNIT SEE FIG. 1103	1	
1102 - 0	772-4765-001	1	GS/INSTRUMENTATION/RCVR ASSY SEE FIG. 1101-20 FOR NHA	REF	
1	777-0103-001	2	COVER	1	
- 2	P330-4058-020	2	SCREW, MACH., STL, FH, 6-32 X 5/16 77250 330-4058-020 AP	6	
3	768-9029-001	3	GUIDE	2	
- 4	MS20426AD2-3 5	3	RIVET, SOLID, AL, FH, 0.022 DIA X 0.218 LG SHK 305-1350-010 AP	12	
5	768-7269-001	4	RAIL, GUIDE P	1	
6	768-7271-001	4	RETAINER, SPG P	1	
7	768-7272-001	4	SPRING, WAVE P	1	
- 8	MS20426AD2-3	4	RIVET, SOLID, AL, FH, 0.062 DIA X 0.187 LG SHK 305-1352-000 AP FOR 5 THRU 7	4	
- 9	MS20426AD2-4	4	RIVET, SOLID, AL, FH, 0.062 DIA X 1/4 LG SHK 305-1353-000 AP FOR 5 THRU 7	1	
- 10	310-0724-000	4	WASHER, FLAT, SST, 0.068 ID, 0.187 OD COML AP FOR 5 THRU 7	1	

GROUP ASSEMBLY PARTS LIST



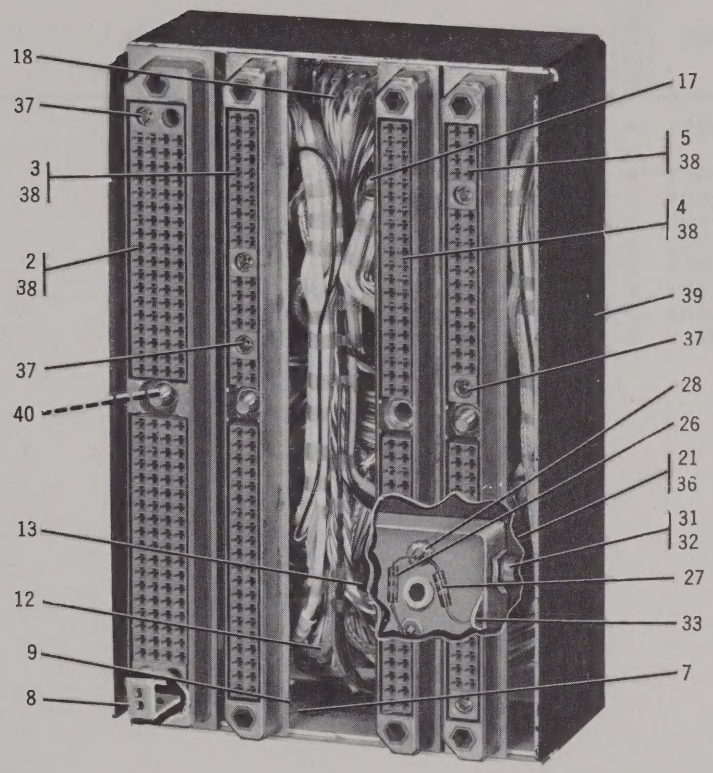
GS/Instrumentation/Receiver Assembly
Figure 1102

FIG. - ITEM	PART NO.	INDENT.	NOMENCLATURE	UNITS PER ASSY.	USAGE CODE
11	768-9030-001	3	GUIDE	1	
- 12	MS20426AD2-3 5	3	RIVET, SOLID, AL, FH, 0.022 DIA X 0.218 LG SHK 305-1350-010 AP	6	
13	768-7269-002	4	RAIL, GUIDE P	1	
14	768-7271-002	4	RETAINER, SPG P	1	
15	768-7272-001	4	SPRING, WAVE P	1	
- 16	MS20426AD2-3	4	RIVET, SOLID, AL, FH, 0.062 DIA X 0.187 LG SHK 305-1352-000 AP FOR 13 THRU 15	4	
- 17	MS20426AD2-4	4	RIVET, SOLID, AL, FH, 0.061 DIA X 1/4 LG SHK 305-1353-000 AP FOR 13 THRU 15	1	
- 18	310-0724-000	4	WASHER, FLAT, SST, 0.068 ID, 0.187 OD COML AP FOR 13 THRU 15	1	
19	768-9028-001	3	GUIDE	2	
- 20	MS20426AD2-3 5	3	RIVET, SOLID, AL, FH, 0.022 DIA X 0.218 LG SHK 305-1350-010 AP	10	
21	768-7268-002	4	RAIL, GUIDE P	1	
22	768-7270-002	4	RETAINER, SPG P	1	
23	768-7272-001	4	SPRING, WAVE P	1	
- 24	MS20426AD2-3	4	RIVET, SOLID, AL, FH, 0.062 DIA X 0.187 LG SHK 305-1352-000 AP FOR 21 THRU 23	4	

GROUP ASSEMBLY PARTS LIST

FIG. - ITEM	PART NO.	INDENT.	NOMENCLATURE		UNITS PER ASSY.	USAGE CODE
- 25	MS20426AD2-4	4	RIVET, SOLID, AL, FH, 0.062 DIA X 1/4 LG SHK 305-1353-000 AP FOR 21 THRU 23		1	
- 26	310-0724-000	4	WASHER, FLAT, SST, 0.068 ID, 0.187 OD COML AP FOR 21 THRU 23		1	
27	772-4766-001	2	COVER, RCVR ASSY P		1	
28	772-0790-001	2	1051B-1 NAVIGATION RECEIVER SEE COLLINS PUBLICATION 523-0759579-001113		1	
29	757-0701-001	2	844A-1 VOR/LOC INSTRUMENTATION PLANAR ASSEMBLY SEE COLLINS PUBLICATION 523-0759580-001113		1	
30	757-0700-001	2	951A-1 GLIDESLOPE RECEIVER SEE COLLINS PUBLICATION 523-0759581-001113		1	
1103 - 0	772-0824-001	1	INTERCONNECT UNIT SEE FIG. 1101-21 FOR NHA		REF	
1103 - 0	772-0824-002	1	INTERCONNECT UNIT SEE FIG. 1101-21 FOR NHA		REF	
- 1	757-0709-001	2	WIRING HARNESS		1	
2	777-0622-001	3	CONNECTOR	J1	1	
3	772-0700-001	3	CONNECTOR	J2	1	
4	772-0698-001	3	CONNECTOR	J3	1	
5	772-0699-001	3	CONNECTOR	J4	1	
- 6	P330-4058-020	3	SCREW, MACH., STL, FH, 6-32 X 5/16 77250 330-4058-020 AP FOR 2 THRU 5		8	
7	768-3435-001	3	BRACKET, CONN		6	
8	768-3435-002	3	BRACKET, CONN		2	
9	F12NKCFM2-62	3	NUT, SELF-LKG, CLINCH, CAD. PL STL, 6-32 72962 333-0986-000		8	
- 10	MS51957-13	3	SCREW, MACH., SST, PAN HD, 4-40 X 1/4 343-0133-000 AP FOR 7 THRU 9		16	
- 11	310-0278-000	3	WASHER, LOCK, SST, 0.115 ID, 0.202 OD COML AP FOR 7 THRU 9		16	
12	DPX2CA32W2P57P34B0002	3	CONNECTOR 71468 370-5234-000	P1	1	
13	549-6138-002	3	TERMINAL, LUG		1	
- 14	92-1660-40	3	NUT, SELF-LKG, HEX., CAD. PL BRS, 4-40 72962 333-1405-070 AP FOR 12 AND 13		3	
- 15	P330-2291-000	3	SCREW, MACH., SST, FH, 4-40 X 5/16 77250 330-2291-000 AP FOR 12 AND 13		3	
- 16	P330-2292-000	3	SCREW, MACH., SST, FH, 4-40 X 3/8 77250 330-2292-000 AP FOR 12 AND 13		1	
17	DPA60	3	CAP 71468 370-2453-010		1	
18	DPAF32-34S	3	CONNECTOR 71468 370-2451-010	P2	1	
- 19	92-1660-26	3	NUT, SELF-LKG, HEX., CAD. PL BRS, 2-56 72962 333-1405-030 AP		4	
- 20	MS51959-3	3	SCREW, MACH., SST, FH, 2-56 X 1/4 342-0133-000 AP		4	

GROUP ASSEMBLY PARTS LIST



Interconnect Unit
Figure 1103

FIG. - ITEM	PART NO.	INDENT.	NOMENCLATURE		UNITS PER ASSY.	USAGE CODE
21	772-8704-001	3	ATTENUATOR		1	
- 22	MS35649-44	3	NUT, PLAIN, HEX., SST, 4-40 313-0043-000 AP		1	
- 23	MS35338-135	3	WASHER, LOCK, SST, 0.115 ID, 0.212 OD 310-0279-000 AP		1	
- 24	541-5989-002	3	SPACER, SLV AP		1	
- 25	P342-0500-000	3	SCREW, MACH., CAD. PL STL, 10-24 X 2-3/4 77250 342-0500-000 AP		1	
26	RC07GF561K	4	RESISTOR, FXD, 560 OHMS 10%, 1/4 W 745-0740-000	R1	1	
27	RC07GF560K	4	RESISTOR, FXD, 56 OHMS 10%, 1/4 W 745-0704-000	R2	1	
28	TF305	4	TERMINAL 98291 306-1018-000		2	
- 29	MS51957-1	4	SCREW, MACH., SST, PAN HD, 2-56 X 1/8 343-0122-000 AP		2	
- 30	310-0070-000	4	WASHER, LOCK, SST, 0.097 ID, 0.165 OD COML AP		2	
31	425-1601-000	4	CABLE, RF, 5 FT 10 IN. 05973		AR	
32	768-5070-001	4	SUPPORT, CABLE P		3	
33	2104-08-02-252ON	4	TERMINAL 78189 304-0319-000		1	
- 34	544-8678-002	4	NUT, PLAIN, HEX. AP FOR 32 AND 33		3	

GROUP ASSEMBLY PARTS LIST

FIG. - ITEM	PART NO.	INDENT.	NOMENCLATURE	UNITS PER ASSY.	USAGE CODE
- 35	MS35338-137	4	WASHER, LOCK, SST, 0.168 ID, 0.280 OD 310-0283-000 AP FOR 32 AND 33	3	
36	768-1379-001	4	CHASSIS, ELECTRICAL EQUIP.	1	
37	31-1067-001	3	CONTACT 71468 372-2519-250	3	
38	030-1918-000	3	CONTACT 71468 372-2514-010	175	
39	768-8723-001	2	HOUSING, ADAPTER P	1	
40	768-3432-003	2	BUSHING	3	
- 41	768-3431-001	2	STOP NUT AP FOR 39 AND 40	3	
- 42	768-3430-002	2	WASHER AP FOR 39 AND 40	3	
- 43	AN50110-32	2	SCREW, MACH., CAD. PL STL, FIL H, 10-32 X 2 347-0410-000 AP FOR 39 AND 40	3	

COLLINS